INTERSTATE HIGHWAY 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

A Report to

The Montana Highway Commission

February, 1961

MEISSNER ENGINEERS, INC.

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By

Meissner Engineers, Inc.

Chicago, Illinois

February, 1961

MEISSNER ENGINEERS INC. · 300 WEST WASHINGTON · CHICAGO 6, ILLINOIS

February 22, 1961

Montana Highway Commission
Helena, Montana

Gentlemen:

We are pleased to submit herewith our engineering report for the Route Location Study of Federal Aid Interstate 90 from Three Forks to Bozeman, Montana.

An investigation has been made of all possible alignments between these two cities. The three routes that appeared the most feasible have been selected for presentation in this report. Written descriptions of these routes, accompanied by plans, profiles, and cost estimates, are included herein.

The most desirable alignment, from all aspects, has been recommended. As the recommended alignment provides good service to the various towns involved, is relatively economical to the road user, and keeps right-of-way damage to an absolute minimum, it should be generally well received.

We would like to take this opportunity to extend our sincere appreciation to members of the Montana Highway Department for their continual cooperation and valuable assistance during all phases of this reconnaissance study.

Sincerely yours,

MEISSNER ENGINEERS, INC.

Robert C. Meissner,
President

RCM/nw

CONSULTING ENGINEERS · DESIGNERS · CONSTRUCTORS · TELEPHONE FI 6-7171 · TELETYPE CG 2058 · CABLE MEISING

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INTRODUCTION

On September 28, 1960, Meissner Engineers, Inc., was authorized to proceed with a Route Location Study for Federal Aid Interstate Route 90 from Three Forks to Bozeman, Montana.

The towns affected by the proposed Interstate facility would be: Three Forks, (population 1161); Logan, (population 207); Manhattan, (population 889); Belgrade, (population 1057); and Bozeman, (population 13,361).

Any direct route from Three Forks to Bozeman would traverse the fertile Gallatin Valley, one of the most important agricultural areas in the northern Rocky Mountain States. Numerous streams flow through the valley. The larger ones are fed by melting snow from the mountains to the south and are perennial.

An elaborate and extensive network of irrigation ditches dissects the valley. Forage crops and grains are produced in the irrigated areas. The non-irrigated areas are utilized primarily for grazing.

All feasible locations for the proposed Interstate facility have been investigated within a band of approximately five miles in width. As studies progressed, less desirable alignments were gradually discarded until only three alternate alignments remained. These alignments have been designated Routes 1, 2 and 3. Route 1 generally follows the abandoned Northern Pacific Railroad right-of-way to the north of U.S. 10. Route 2 utilizes the U.S. 10 right-of-way and Route 3, the alignment we recommend, lies to the south of U.S. 10 and the operating Northern Pacific Railroad. These three alignments are described in detail, by means of exhibits and text, in subsequent sections of this report.

A comparison of Routes 1, 2 and 3 appears in Table 1. As indicated, Route 3 is the shortest, least expensive, and is the most economical for the road user. Because it is necessary for any Interstate alignment to traverse the Gallatin Valley and because such agricultural land is rare in the State of Montana, a great deal of consideration has been

given to the properties that would be affected by the proposed facility. To keep right-of-way damages to a minimum through these valuable properties, the recommended alignment is generally located at the extremities of properties traversed. In this manner, an unduly large number of farms are not dissected. As a consequence, the number of bridges, frontage roads, equipment passes and stock passes is also kept to a minimum.

With the Route 3 scheme, Interstate 90 would provide good service to the cities and the existing access pattern would remain essentially undisturbed. The soils which would be encountered under the recommended alignment are generally very good. Construction could be accomplished with very little disruption to U.S. 10 traffic and a large amount of detour roads, costly to the road user as well as the State, could be avoided.

Because of these major considerations and lesser factors mentioned in the section entitled, "Description of Routes Studied", Route 3 is recommended from Three Forks to Bozeman.

The recommended line is 30.2 miles long, has three diamond interchanges and one partial cloverleaf interchange. A total of 41 bridges is involved. The maximum gradient is 3.0% and the sharpest curve is 1° - 45'.

The estimated total cost of the project, including right-of-way, engineering and contingencies is $15,454,400.

Although it is impracticable to acknowledge adequately all the contributions which others have made to this report, we especially desire to gratefully acknowledge the valuable assistance and cooperation provided us by personnel of the Montana State Highway Department, the State Engineer's Office, the Bureau of Public Roads, the Northern Pacific Railroad, the Chicago Milwaukee St. Paul and Pacific Railroad, and the various local utilities concerned.

DESIGN STANDARDS

The following design criteria are to supplement the "Geometric Design Standards for the National System of Interstate and Defense Highways", approved by the American Association of State Highway Officials and adopted by the States July 12, 1956.

Standard practices of the State of Montana Highway Commission will be followed wherever possible. The controls that follow are minimum standards. Designs will be to values as high as are commensurate with conditions.

Tables, figures and page numbers below refer to the 1954 edition of A. A. S. H. O. "Policy on Geometric Design of Rural Highways".

Roadway Typical Sections

See Exhibit 3

Design Speed

Freeway	70 M. P. H.
Ramps	Table IX - 2 (p. 393)
Frontage Roads and Intersecting Roads	40 - 60 M. P. H.

Maximum Horizontal Curvature

Freeway	3° - 30'
Ramps	35 M. P. H. or less - Table VII-3 (p. 263). Greater than 35 M. P. H. Table III-6 (p. 133)
Frontage Roads and Intersecting Roads	In conformance with A. A. S. H. O.

Spirals

Freeway	All curves 1° - 30' or sharper
Ramps, Frontage Roads and Intersecting Roads	None required.

Superelevation

Freeway	Table III-10 (p. 141)
Ramps	35 M.P.H. or less - Table VII-12 (p. 291). Greater than 35 M.P.H. Table III-10 (p. 141)
Frontage Roads and Intersecting Roads	Table III-10 (p. 141)

Maximum rate of superelevation will be 0.08 ft./ft.

Superelevation Transition Lengths

Freeway	Table III-10 (p. 141)
Ramps	Table VII-13 (p. 292)
Frontage Roads and Intersecting Roads	Table III-10 (p. 141)

Gradients

Freeway	3% Maximum
Ramps	6% Maximum
Frontage Roads and Intersecting Roads	In conformance with A.A.S.H.O.

When grades of less than 0.5% are used, median ditches and side ditches will be specially designed to provide a minimum longitudinal gradient of 0.5%.

Vertical Curves

Freeway	Figures III-21 and III-22 (pp. 456 and 457) Minimum length will be 800'.
Ramps	Figures III-21, III-22 and VII-22 (pp. 456, 457, and 496)
Frontage Roads and Intersecting Roads	Figures III-21 and III-22 (pp. 456 and 457)

Drainage

Large and small drainage structures will be designed in conformance with highway department standard practices and local experience with existing structures. The Bureau of Public Roads "Highway Drainage Manual" will be used as a guide.

Minimum diameter of pipe culverts under the Interstate roadways will be 24". Minimum diameter of pipe culverts for median outlets, ramps, intersecting roads, and frontage roads will be 18".

For bridges, a 3 foot minimum clearance will be provided between extreme high water and low steel or low concrete.

Structure Typical Sections

See Exhibit 4

Structure Design Specifications

1957 Edition of A. A. S. H. O. "Standard Specifications for Highway Bridges", and subsequent approved tentative revisions.

Structure Loading

Interstate Highway structures:
H20 - S16 Modified for military vehicles.

Primary highway structures:
H20 - S16

Local Highway structures:
H15 - S12

Minimum Horizontal Clearances

Structures over the Interstate Highway - Normally, 4.5' left and 10.0' right will be provided from the edge of a traffic lane to the face of pier. The right shoulder may be reduced to 8.0' where the approach shoulder is 8.0' or less.

Structures over Primary Roads - 4.5' left and 6' to 8' right will be provided from edge of traffic lane to face of pier.

Structures over Local Roads - 4.0' left and 4.0' right will be provided from edge of traffic lane to face of pier.

Structures over Railroads - Dimensions from centerline of track to face of pier shall be as follows: N.P.R.R. - 12.0' left and right, C.M.St.P. & P.R.R. 10.0' left and right. In areas where off-track maintenance is anticipated 18.0' from centerline of track to face of pier will be provided on one side. Effects of superelevation will be considered when locating piers.

Minimum Vertical Clearances

Structures spanning the Interstate Roadways will provide a minimum vertical clearance of 17' - 0" over the traffic lanes and over the useable width of shoulders.

Structures spanning highways other than the Interstate Roadway will provide a minimum vertical clearance of 14' - 4" over the traffic lanes and over the useable width of shoulders.

Minimum vertical clearance at structures over railroads having electrically operated locomotives will be 26.0'. In addition to the 26.0', 0.5' will be provided for future track adjustment.

Minimum vertical clearance at structures over railroads not having electrically operated locomotives will be 23.0'. In addition to the 23.0', 0.5' will be provided for future track adjustment.

DESCRIPTION OF ROUTES STUDIED

In the initial phase of our study, many possible alignments were investigated. One by one these alternates were abandoned as it became evident they were undesirable for one reason or another. After discarding the relatively undesirable alignments we were left with several practicable route locations. Descriptions of these routes follow:

Route 1

Route 1 is shown in Exhibits 7 - 14 and 21 - 23, inclusive. From Three Forks to Logan, Route 1 is coincident with Route 3. West of Three Forks the Interstate alignment is not yet rigidly fixed. The alignment we have shown at the extreme west end of our project is relatively flexible and could lend itself to either of several schemes. A slight alignment modification at the west end of our project would not affect the results of our route comparison study, as all alternate routes are based on the same alignment from Three Forks to Logan.

From Three Forks to Logan three possible alignments were initially considered. On the northerly alignment the south right-of-way line of F.A.I. 90 would coincide with the north right-of-way line of existing U.S. 10. Just west of Logan, this alternate would cross over U.S. 10, the Chicago Milwaukee St. Paul and Pacific Railroad, and the Northern Pacific Railroad by means of long structures. At the Logan Interchange, all three alternate alignments become coincident.

An alignment was considered on the north side of U.S. 10 utilizing the existing right-of-way. The advantage of this scheme would be that less right-of-way acquisition would be required. Disadvantages are that a large amount of frontage road would have to be constructed on the north side of F.A.I. 90, the existing roadway would have to be reconstructed to conform to Interstate standards, and both cross road relocations and a very long structure would be required at Trident Road (F.A.S. 286).

Our third alternate from Three Forks to Logan is located on the south side of the railroads. At the Three Forks end the line is located so as to achieve good structure conditions over the railroads and across the

Madison River. The alignment was then established so that the north line of F.A.I. 90 is approximately the same as the south line of the Northern Pacific Railroad. The reason for locating the line adjacent to the railroad is to keep severance damage to a minimum. It is necessary to remain close to the N.P.R.R. just west of Logan so that a feasible profile can be developed. The south alternate merges with the two north alternates south of Logan.

After discarding the scheme which utilized the U. S. 10 right-of-way, it became necessary to compare only the other two alternates. Cost comparisons were made between the extreme north alternate and the south alternate. Cost of the north alternate was estimated as $2,904,000 and that of the south alternate as $2,892,000. The south route has flatter curvature, is less costly, and is closest to the town of Three Forks. Consequently, the south alternate is recommended.

Three alternate alignments were considered at Logan.

The northerly alternate was along the north shore of the Gallatin River. Although it was possible to develop good horizontal alignment along this route, satisfactory vertical alignment could not be obtained. Eighty five feet cuts and eighty five feet embankments would be required on this route north of the N.P.R.R. property at the east side of Logan.

The intermediate alternate roughly paralleled U.S. 10 through the city of Logan. The high cost of right-of-way and comparatively poor horizontal alignment (three - 3.5^{o} curves) eliminated this scheme from further consideration.

The south alternate passes to the south of Logan. Good alignment and profile are obtained in this location and right-of-way is relatively inexpensive. The south alternate is recommended.

From a point south of Logan to the point where Route 1 joins the abandoned N.P.R.R. (Sta. 800) the line has been located so as to achieve good skew conditions at the two grade separations. East of the separation at Sta. 725 the line has been kept as far north as possible, to keep right-of-way damage to a minimum.

An interchange has been placed on the main north - south route leading into Manhattan.

Between the Manhattan Interchange and the Belgrade Interchange, grade separations have been located so as to keep adverse travel distances to a minimum.

At Belgrade, an interchange has been placed on F.A.S. 290, the main route extending northerly from the town. We would recommend relocating the cross road to obtain a better skew condition for the bridge. By relocating the cross road it is also possible to obtain straighter ramp alignment in the northeast and southwest quadrants.

Two grade separations have been located at desirable locations between the Belgrade Interchange and the Bozeman Interchange. Interchange with U.S. 10 is made to the north of existing U.S. 10, so that only one grade separation structure is required.

East of the F.A.I. 90 - U.S. 10 interchange, and through Bozeman, the line has been located so as to keep right-of-way damages to a minimum.

With the Route 1 scheme, U.S. 10 would remain open to traffic from Three Forks to Bozeman.

Route 2

Route 2 is shown in Exhibits 15 - 24, inclusive. From Three Forks to Manhattan Route 2 is coincident with Route 3.

Straight and nearly straight alignments were investigated between Three Forks and Manhattan and between Logan and Manhattan. Study of these routes was abandoned when it became apparent that either undesirable gradients or a prohibitive amount of rock excavation would result should either of these lines be selected. A considerable amount of property dissection was another undesirable feature of the straight and nearly straight alignments.

To the south and east of Logan the topography is quite rugged. In this area several locations for the centerline were investigated and the one yielding the most desirable profile, with the least amount of earthwork, was selected. Proceeding easterly, the alignment was placed adjacent to the Chicago Milwaukee St. Paul and Pacific Railroad, so that the existing access pattern would be disturbed as little as possible, property dissection would be avoided, and severance damages would be kept to a minimum.

At Manhattan, the Interstate roadways are located as close to the town as existing construction permits. Interchange has been made with the main route entering Manhattan from the south, F. A. S. 288. This highway has been relocated so as to eliminate an at-grade intersection with the C. M. St. P. & P. R. R. By relocation of F. A. S. 288, it is brought into the center of town and a good angle of intersection between F. A. I. 90 and F. A. S. 288 results.

To the east of Manhattan, the centerline of F. A. I. 90 would be located to the north of U. S. 10. The U. S. 10 right-of-way would be utilized and the existing facility would be reconstructed in accordance with our recommended typical section for Interstate roadways. Consideration was given to placing the proposed right-of-way north of the existing right-of-way. U. S. 10 might then remain in place as a frontage road. An additional frontage road would be required to the north of the Interstate alignment to serve individual property owners in this area who formerly had access to U. S. 10. As this alternate scheme would involve more right-of-way acquisition and consequently be more expensive, it was eliminated from further consideration.

At Belgrade, interchange is made with F. A. S. 290 (Broadway St.) the main roadway providing ingress to the town from the north. At the northeast corner of Belgrade it would be necessary to acquire Gallatin Airfield property. From Belgrade to the F. A. I. 90 - U. S. 10 interchange, near Bozeman, the interstate alignment would utilize the existing U. S. 10 right-of-way to avoid property dissection and to keep right-of-way acquisition to a minimum. Through Bozeman, Route 2 is coincident with Route 1.

Under the Route 2 scheme, U. S. 10 would remain open to traffic from Three Forks to Manhattan. East of Manhattan frontage roads and existing roads would accommodate the short-trip local traffic presently using U. S. 10. A substantial amount of traffic detouring during the construction period would be required under this scheme.

Route 3 (Recommended Alignment)

Route 3 is shown in exhibits 21 - 30, inclusive. From Three Forks to Manhattan Route 3 is identical to Route 2.

Between Manhattan and Belgrade Route 3 is located immediately south of the Northern Pacific Railroad right-of-way. In this manner the existing access situation is only slightly disturbed, property dissection is avoided, and right-of-way and severance damages would be kept to a minimum.

At Belgrade, the recommended alignment provides interchange with the main north-south highway, F. A. S. 291. Just east of Belgrade, Route 3 has been kept to the south so as to provide space for the future development of Belgrade and to eliminate acquisition of commercial property.

East of the intersection of U.S. 10 with the abandoned N. P. R. R., the interstate roadway would be adjacent to the railroad right-of-way. The local access pattern would remain essentially undisturbed and dissection of valuable agricultural land would be avoided.

Between the point where the proposed alignment departs from the N. P. R. R. right-of-way and the point where it crosses U.S. 10, the alignment follows property lines so as to avoid property dissection and extensive right-of-way damage.

An interchange would be provided at the junction of F. A. I. 90 and U.S. 10 and highway grade separation structures are recommended at Rouse Ave. (F.A.S. 293) and "L" Street. The Rouse Ave. - N. P. R. R. - I-90 intersection would require long arm gates with audible and visual protection.

An alternate alignment, slightly shorter than the recommended alignment, was studied in the Bozeman area. The line has been designated 3A and is shown on exhibits 29 and 30. Cost estimates were made on both alignments and Route 3 was found to cost $350,000 less than Route 3A. Although pavement costs are less on 3A, an additional grade separation is required and right-of-way and utility costs would be greater. Because of the above reasons, Route 3A was rejected.

A planning board is presently considering a comprehensive plan for future roadways in the Bozeman area. Our recommended alignment is compatible with their proposed plan.

Routes 4 and 5

Routes 4 and 5 are shown in Exhibit 2.

Route 4 is the result of an attempt to establish a line between Manhattan and Bozeman to the south of U.S. 10. Early in our investigation it became apparent that a straight or nearly straight line would dissect a large number of properties and would require a large amount of frontage road. Right-of-way costs would be high and many costly equipment and stock passes would be required. Route 4 would have to be located approximately as shown to avoid excessively high right-of-way costs. A comparison between Routes 3 and 4 would be as follows:

Route 3 is shorter, consequently it would be less costly, require less right-of-way acquisition and road-user costs would be less. It would provide better service to Belgrade. As Route 3 is obviously the more desirable alignment, no further investigations of Route 4 were made.

Route 5 would be located adjacent to the Chicago Milwaukee St. Paul and Pacific Railroad between Three Forks and the West Gallatin River. It would utilize a portion of the abandoned N.P.R.R. right-of-way east of the river. Very little property dissection would result with this route and right-of-way costs would be relatively low.

A cost comparison was made between Routes 3 and 5. Because of its greater length, Route 5 was found to be considerably more expensive. It would also provide relatively poor service to Belgrade and road-user costs would be higher than on Route 3. For these reasons, study on Route 5 was discontinued.

LEGEND FOR SOILS AND GEOLOGIC EXHIBITS

Soils

Qs	Silts containing minor percentages of fine sand and clay to depths generally in excess of 6 feet.
Qs'	Silts to a depth of approximately 2 feet, underlain by fine sandy silt to depths generally in excess of 6 feet.
Qc	Fine to medium sands with variable silt and gravel contents. Colluvial wash from residual soil areas.
Qal	Sorted silts and sandy silts, underlain by silty gravel and cobbles generally within 6 feet of the ground surface. High organic content in surface silts in poorly drained areas.
Qg'	Gravel and cobbles mantled with a surface veneer of silt generally less than 3 feet thick. Organic silts present in minor stream beds and local depressions.
Qg	Gravel and cobbles to depths in excess of 10 feet, overlain by generally less than 1 foot of gravelly silt.
Ts	Residual soils resulting from in-place weathering of Tertiary sediments. Silts, sandy silts, and gravelley silts with occasional local gravel deposits of shallow depths.

Rocks

Bt	Belt Formation - Predominantly Conglomerates
Ꞓf	Flathead Formation - Quartzite and Shale
Ꞓg	Gallatin Formation - Limestone and Shale
Dj	Jefferson Formation - Limestone
Dt	Three Forks Formation - Limestone, Sandstone and Shale
Cm	Madison Formation - Limestone
Cq	Quadrant Formation - Limestone and Cherty Limestone
Je	Ellis Formation - Limestone and Quartzite

SOILS AND GEOLOGY

Purpose and Methods of Soils and Geologic Study

A reconnaissance study was made for the purpose of determining the soils and geologic conditions of the area and the effect which these conditions might have upon the construction costs and future performance of alternate routes being considered between Three Forks and Bozeman, Montana. The study was performed primarily through interpretation of surface and subsurface conditions from aerial photographs at a scale of 1" = 2500'. Supplementary information was obtained from published documents and a brief field check was performed to verify expected conditions. The results of the study are presented below and in Exhibits No. 36 through 40, inclusive.

Geology

The oldest rocks reported in the general region are crystalline schists and gneisses of the Archeozoic era. They are highly metamorphosed and contorted and in Pre-Cambrian times most likely made up the major portion of the land mass of the surrounding country. Through Pre-Cambrian times these rocks were subjected to erosion, and surface degradation supplied the sediments for the formation of the Belt series of sedimentary rocks. During the formation of the Belt series, the area sank and the sea spread over a vast extent of the country. The invasion of the sea marked the beginning of Cambrian times with the deposition of the Flathead formation. In the southern portion of the area the Flathead quartzites were deposited upon the Archean gneisses and, to the north, on the sediments of the Belt series. Limestones, sandstones, and shales were deposited over the area during the Paleozoic and Mesozoic eras with limestones predominating during the Carboniferous period, and sandstones and limestones during the Jurassic period. Toward the close of the Cretaceous period a general uplift of the region began. Shortly after deposition of the Laramie formation an upward movement, marked with folding and faulting, occurred and the region was subjected to an erosive cycle. Coincident with this, volcanic activity commenced and continued well into Tertiary times. Mountain ranges were formed and subsequent erosion resulted in the formation of fresh water lakes which lasted until the Pleistocene period was well advanced. Volcanic dust settled upon the lakes and surrounding ground, and partially filled the lake basins. Additional sedimentation occurred through removal

of the volcanic dust from the surrounding ground and erosion of the exposed shore rocks. Eventually outlets were formed for the lakes and, as they drained, all of the volcanic dust was removed from the land and much of the lake bed sediments themselves were removed. Later, glaciation occurred on a local scale in the mountain ranges and some glacial outwash was deposited over the remnants of the Tertiary lake beds. Following glacial times, erosion and sedimentation resulted in the formation of the present landforms exhibited in the region today.

The study area lies almost entirely within the Gallatin Valley of southwestern Montana with only the western portion extending beyond, across a relatively low plateau into the Madison Valley. The limits of the study area are best defined as the Madison River on the west, a series of ridges to the north of the Gallatin River on the north, the Bridger Mountain Range on the east, and the Gallatin Mountains on the south.

The area lies entirely within the boundaries of one of the previously mentioned Tertiary aged lakes, Lake Gallatin. A large portion of the area, however, has been, in more recent times, mantled with a substantial accumulation of alluvial, colluvial, and outwash materials. From the information gathered, it appears that the following sequence of events may have occurred.

The general uplifting and folding which occurred at the close of the Gretaceous era resulted in the removal, through erosion, of all of the Paleozoic and Mesozoic sediments deposited in the study area, excepting for a small area in the vicinity of the town of Logan. Coincident with this event, the area was inundated and Tertiary aged Lake Gallatin was formed. Extensive lake bed sediments were deposited over the entire area, primarily as a result of the previously mentioned mantle of volcanic ash. At the borders of old Lake Gallatin, the southern and eastern extremities of the study area, the sediments contained appreciable amounts of conglomeritic materials due to shore erosion. In the central portion of the lake, the central and northern portions of the study area, the sediments were primarily fine grained. Eventually Lake Gallatin formed an outlet, and as the lake receded, much of the Tertiary sediment was removed from the area and possibly gravel strata were deposited. During or shortly after the recession of the lake, glacial outwash from the surrounding higher mountain ranges flowed over the lake beds and deposited large quantities of granular material along its lower water courses. With the recession of the glaciers, the present stream channels were assumed. Their velocity, while reduced, precluded deposition of fine grained soils, and fine grained colluvial wash was restricted to the Manhattan area and the area between the East Gallatin River and Middle Creek, which was actually then a part of the outwash fan of the Gallatin River. Erosion by the principal streams then caused a lowering of the base level of erosion and the colluvial silts were partially carried away and scattered along the present day flood plains in minor quantities.

Basically then, five radically different areas were formed and occur in the study area. They are: (1) The hard Pre-Tertiary sedimentary rocks in the vicinity of Logan. (2) The weak Tertiary rocks of Lake Gallatin which surround the study area. (3) The granular outwash fans of Pleistocene times which overlay the Tertiary rock and occur primarily in the vicinity of Belgrade and underly the Manhattan terrace. (4) The present day flood plains with a thin veneer of silt over gravels, and (5) The colluvial silts which occur to considerable depths and are found west of Bozeman and on the southern extremities of the Manhattan Terrace.

Soil and Rock Properties

The five basic areas described in Section II have been subdivided where possible into minor classifications based upon depth and texture of the material present and are delineated and described in the geologic exhibits of this Report and below.

Of noteable importance is the occurrance of a relatively clean gravel and cobble stratum which appears extensively throughout the area under a variable cover of silt. This granular stratum was particularly noticeable in the Belgrade area and along the escarpment dividing Manhattan and its surrounding terrace from the Gallatin River. This granular material was also observed in the alluvial plains of the Gallatin, East Gallatin and Madison Rivers and in the low lands west of the City of Bozeman. The stratum is believed to underly the entire central portion of the study area, its limit being the weathered Tertiary rock.

In the higher areas west of Bozeman, from approximately the city limits to the flood plain of Middle Creek; and south and west of the immediate vicinity of the escarpment circling Manhattan, silts and fine sands were observed to depths up to 8 feet without the occurrence of the underlying coarse granular soils. It is anticipated that in these areas, particularly in the vicinity of Bozeman, the fine grained soils extend to considerable depths.

The older Tertiary lake bed sediments were observed along the northern limit of the flood plains of the Gallatin and East Gallatin Rivers, immediately east of Bozeman, and slightly south and approximately parallel to the Bozeman "Hot Springs" branch of the C. M. & St. P. & P. Railroad from Hot Springs to Logan. Along the northern portion of the area these sediments appeared to be almost exclusively a weakly cemented fine grained material with a relatively deep weathered zone of silt and fine sand. The southern sediments and those east of Bozeman contained considerably more granular material and weakly cemented sandstones and conglomerates were observed. Surface weathering has resulted in the formation of local gravel pockets.

Hard rock occurs at or near the ground surface only in the vicinity of Logan. A complete stratographic section from Pre-Cambrian through Cretaceous times can be observed on the north side of the Gallatin River in that area. A portion of these rocks extend across the river flood plain to the high ground south of Logan where they disappear under the Tertiary lake bed sediments. As the terrain north of Logan precludes a logical location for a highway, a detailed description only of the rock formations south of Logan will be given. The formations present from oldest to youngest are:

1. The Flathead Formation - Lower Cambrian age - approximately 125 feet of quartzite overlain by approximately 300 feet of soft shale with thin bands of limestone.

2. The Gallatin Formation - Upper Cambrian age, from bottom to top, 125 feet of massive limestone, 280 feet of Obolella shale, 260 feet of massive limestone, 30 feet of Dry Creek shales, and 145 feet of laminated (4' to 8') pebbly limestone.

3. The Jefferson Formation - Lower Devonian age, approximately 700 feet of limestone.

4. The Three Forks Formation - Upper Devonian age, approximately 150 feet of predominately shale with some limestone and laminated sandstone.

5. The Madison Formation - Lower Carboniferous age, approximately 1200 feet of massive and laminated limestone.

As can be seen from the above, limestone predominates in the area south of Logan. The rock has a north-east, south-west strike and appears to be dipping at approximately 30° northwest. Where observed it was relatively competent although some solution voids were noted. The thin tertiary mantle prohibits close observations of the hard rock over much of the area south of Logan, however, severe thrust faulting and folding can be seen north of Logan and it seems reasonable to assume that planes of structural weakness were formed and extend to the south.

The remaining portions of the area are made up of recent flood plains bordering the present day major streams. Considerable sorting has occurred in these areas, resulting in a highly variable depth of silt cover over a predominantly granular soil. Local deposits of high organic content soils occur, particularly bordering the East Gallatin River.

Engineering Analysis

A study of the soils and topographic maps shows that Route No. 1, for the large majority of its length, traverses soils which are predominantly loose silts and fine sands and which are located in an area where a very high ground water table exists. In addition, local pockets of high organic content materials are expected within the right-of-way. These three conditions create an undesirable location for a highway for several reasons, the major being the high frost-heave susceptibility of the subgrade.

Analysis of climatological data of the area based upon a method developed by the U. S. Army Corps of Engineers indicates a design depth of frost penetration of 75 inches. The information, when considered with the fact that sorting of the soils in the area has created a differential heave potential of a relatively large magnitude, confirms the need of locating the pavement well above the surrounding ground surface. To provide adequate pavement performance, a minimum embankment height of 5 feet is recommended. The fill material should be predominantly granular with less than 7 per cent by weight smaller than 0. 02 mm in size.

In the low lying areas which surround the major streams, local pockets of highly organic soils are expected, particularly bordering the Gallatin River west of its junction with the East Gallatin River, and along the East Gallatin River. These pockets are not expected to extend to a great depth, but should be removed prior to roadway construction. They can best be located by hand auger borings prior to construction or, with adequate supervision, can be removed at the discretion of the engineer during construction.

Stability of embankments is not expected to create any problems along Route 1. The fill slopes of the Montana State Standards will be more than adequate. With the removal of all organic soils, settlement of embankments is also not expected to be critical, due to the general close proximity to ground surface of granular soils.

Route Nos. 2 and 3 closely parallel each other and, on the basis of soils analysis, may be considered as identical. As with Route No. 1, the primary detrimental soil condition to be considered is that of frost-heave potential. However, for the most part, subsoil conditions are relatively uniform for large segments of the routes and ground water conditions are not as severe as on Route No. 1. Both of these facts tend to lessen the probability of differential heave of the subsoil. This is particularly true in the vicinity

of Belgrade where soil and drainage conditions are generally excellent. It is expected that the typical section shown as Exhibit 3 will, in general, provide reasonable protection against differential heave and pavement distress due to softening of the subgrade during the spring thaw. Minor modifications of the typical section are expected for specific areas.

In the area where Routes 2 and 3 are comparable to Route 1, stability and settlement problems are not anticipated. In this respect, conditions are similar to those outlined for Route 1 with the exception that only a very minor amount of organic soils are expected on Routes 2 and 3.

All of the study lines are coincident in the vicinity of the town of Logan. An important consideration within this area is the probability of alternating beds of hard and soft rock. This detrimental condition is further aggravated by the inclination of the bedding plains of the rock and the possibility of structural inconformities. No serious stability problems are anticipated, however, if adequate slope design is performed. To facilitate this design, it is recommended that borings be performed for all major cuts in this area and that a detailed geologic study be made.

On the basis of the available information cut slopes of 1/2:1 for limestone, 1-1/2:1 for shale and Tertiary rocks, and 1:1 to 1/2:1 for sandstones appear reasonable. Benching of the rock cut slopes is recommended with a maximum vertical interval of 30 feet between benches. The use of longitudinal underdrains within these cuts should also be considered, if ground water conditions indicate they are warranted.

Granular borrow is readily available throughout much of the study area, primarily in the form of the gravel and cobble stratum which occurs near Belgrade and underlies much of the remaining area. Since the material contains considerable amounts of cobble sized or larger particles, either screening or crushing and screening will be required to meet the grading requirements for subbase course material. In its natural state it will provide excellent fill for crossing low wet areas.

Erosion is a problem which must be considered for all of the study lines. The silt and fine sand soils which occur over much of the area will gulley rapidly if adequate protection is not provided. This will be particularly true for embankments over 10 feet in height and for ditches with velocities in excess of 1.5 feet per second. Sodding of ditches and seeding and mulching of embankments of these types is recommended.

Summary of Soils and Geologic Study

The major problems associated with highway construction and performance within the study area are the presence of a high water table with high silt content soils and the presence of interbedded hard and soft dipping sedimentary rocks. Topography and land-use dictate that the proposed roadway be located within the area of the sedimentary rocks. However, it is possible to avoid a great portion of the area where the high water table-silt condition occurs. In this respect the least advantageous alignment presented in this report is that designated as Route No. 1. For the major portion of its length it lies within an area representative of very poor soil conditions.

In reviewing the location of the two other alignments presented in this report, little or no difference with regard to detrimental conditions can be seen between the two. For all practical purposes, they both traverse routes similar in all respects, as regards soils. Further, a more advantageous route with respect to soils, without sacrificing alignment and adding to the over-all length of the project, is not readily discernible.

BRIDGES

The majority of bridge sites encountered on any of the three alternative alignments are such that conventional, deck type, short span structures offer the most economical solution.

Cost comparisons have been made for reinforced concrete tee-beams, prestressed precast concrete beams, composite and non-composite steel beams. Within the span range considered prestressed beams were found to compare favorably with the other types of construction. Also, factors other than initial cost, such as maintenance, superstructure depth and the use of existing standard shapes were considered. After evaluating all criteria prestressed beams are recommended and are used in the final cost estimates, except for several structures which will be discussed separately.

The over-all dimensions of the structures have been determined by the roadway and crossing requirements at each individual site. Since the project is predominantly rural in character, open end spans have been used in preference to closed abutments.

Special Structures

The structures at Station 148+40 are common to all three lines considered. These structures are over the Milwaukee St. Paul & Pacific Railroad, the Northern Pacific Railroad and the Madison River. Composite steel construction has been recommended for these structures because this type of construction is more adaptable to the conditions at this site. The increased cost of the river foundations is reflected in the higher unit cost.

The structure at Station 1624+50 is part of Line No. 3 only. At this location U.S. 10 crosses the existing tracks of the N.P.R.R. on a three span continuous steel beam structure. Since, under the recommended scheme, the N.P.R.R. line would be abandoned and replaced by the new highway, the feasibility of adapting the existing structure to meet the new requirements has been investigated. It has been found that lengthening the structure by the addition of one interior span would satisfy the roadway requirements. However, in addition to adding one span, the existing structure would require expensive modification in order to increase the live load capacity. Also, the existing deck reinforcing would be overstressed under new loading conditions. The cost of extending the existing structure is estimated to be $68,000, the cost of replacement would be $80,800. A new structure would permit the present grade of U.S. 10 to be lowered

by approximately 6 feet with corresponding improvement in the vertical alignment of the interchange. Considering all factors, it is recommended that a new bridge be constructed at this site. The cost estimate for a new structure is indicated elsewhere in this report.

The structures crossing the West Gallatin River at Station 972 + 00, Route No. 1, at Station 1117 + 50, Route No. 2, and at Station 863 + 60, Route No. 3 require river piers which are more expensive than conventional piers. Higher unit prices have been indicated for these structures to reflect the additional substructure costs.

The structures at Station 380 + 30, which are common to all three alternative lines and which cross the county road leading to Logan, are paralleled by an existing railroad trestle. This trestle will have to be modified to accomodate 2-lane traffic on the improved road to Logan. The estimated cost of the structural alterations is $20,000. It is considered feasible to carry out the necessary work without interfering with the railroad operations.

TRAFFIC

The origin-destination data for the traffic assignments were derived from a comprehensive roadside interview study which was conducted by the Planning Survey Division of the Montana Highway Department during the summer of 1958. The information obtained from interviews was tabulated, and the results were given to Meissner Engineers, Inc. so that they might determine the projected traffic volumes for all routes studied.

In any origin-destination study, the total trips in any area can be grouped into three general categories:

(1) External trips having their origin and/or destination outside the study area.

(2) Internal trips having both their origin and destination within the study area, from one internal zone to another.

(3) Local trips having both their origin and destination within one internal zone.

For this study, there were two external stations and seven internal zones considered. They are as follows:

External Stations

1. The area east of Bozeman.
2. The area west of Three Forks.

Internal Zones

1. The Bozeman area.
2. The Belgrade area.
3. The area served by F. A. S. Route 291.
4. The Manhattan area.
5. The Logan area.
6. The Trident area.
7. The Three Forks area.

Recent studies between Great Falls and Vaughn, where the Interstate highway parallels the primary route, indicate that approximately 95% of the total traffic is using the Interstate facility. Traffic counts indicate that a large portion of the total trips in the area are between Great Falls and Vaughn and therefore, are internal in character. Also, because of the interchange spacing on the freeway, it is probable that a very large majority of the purely local trips, i.e., trips having both their origin and destination in either the Great Falls area or the Vaughn area, use the primary route. Therefore, for all practical purposes, all of the external trips, i.e., trips having their origin and/or destination either south of Great Falls or north of Vaughn, are on the Interstate Route.

Applying this reasoning to the Bozeman - Three Forks area, all external trips were assigned to the Interstate Route irrespective of its location. Also, all non-stop trips between Bozeman and Three Forks were assigned to the freeway because of the 32 mile distance between the two towns. Conversely, all purely local trips were assigned to the present highway, because of their probable shortness in relation to the wide interchange spacing on the proposed freeway.

For the internal trip assignments, the procedures outlined in the Bureau of Public Roads instruction manual for the preparation of the 1960 Interstate Estimate, were used without deviation. The necessary distances were obtained from 1" = 1 mile county maps drawn by the Planning Survey Division of the Montana Highway Department. Travel times were computed from distances using the following running speeds:

Freeway	-	60 M.P.H.
Primary Rural Highway	-	45 M.P.H.
City Streets	-	20 M.P.H.

The 1958 traffic volumes on the proposed freeway and those left on the present highway for Routes 1, 2 and 3 are shown in Exhibit 6.

To project these traffic volumes to the ultimate year of 1975, the following formula was used:

Expansion Factor = G (1 + SLI)

Where G = Trip generation factor

S = Statewide percentage traffic increase forecasted for the period from 1958 to 1975.

L = Factor to convert S to a particular location.

I = Factor to reflect more rapid rate of growth along the Interstate System.

The G, S, L, and I values that were used in this study are as follows:

(1) Interstate Route (Expansion Factor = 2.85)

G = 1.50
S = 0.60
L = 1.30
I = 1.15

(2) Primary Route (Expansion Factor = 1.90)

G = 1.00
S = 0.60
L = 1.30
I = 1.15

(3) Local crossroads (Expansion Factor = 1.60)

G = 1.00
S = 0.60
L = 1.00
I = 1.00

The expanded 1975 traffic volumes on the freeway and those left on the present highway are also shown in Exhibit 6.

In order to determine the number of traffic lanes, it was necessary to determined the percentage of trucks in relation to total traffic and the relationship of the design hourly volume to the annual average daily traffic. It seems reasonable that the Interstate System with its inherently high design standards and control of access will tend to draw a higher percentage of truck traffic than is now travelling on present U.S. 10. Accordingly, it was felt that a value of at least 15% would be reasonable. Since Bozeman is a main gateway to Yellowstone National Park and many other natural wonders, heavy seasonal tourist traffic through the area can be expected to produce fairly high design hourly volumes. Therefore, it was assumed that by 1975 the DHV would be at least 15% of the ADT. Both of these percentages are in line with present AASHO recommendations for rural highways. Applying these values to the 1975 traffic volumes derived in this study, it was found that four lanes are needed throughout on Routes 1, 2 and 3.

Interchanges have been provided for all the major towns. Relatively low traffic volumes indicate that diamond interchanges would serve satisfactorily at Three Forks, Logan, Manhattan and Belgrade. At the U.S. 10 - I-90 interchange near Bozeman, a substantial volume of vehicles make the Northbound to Westbound maneuver. Consequently, a partial cloverleaf interchange with a loop in the northeast quadrant is recommended.

TYPICAL ROADWAY SECTIONS

Typical Sections are shown in Exhibit 3. Lane widths, shoulder widths and cross-slopes are compatible with the American Association of State Highway Officials Interstate Design Standards and Montana State Highway Department current practices. A six inch thickness of Type A - Grade 1 base course will be used for normal conditions. This course will be thickened in areas of high water table and frost-susceptible soil.

In general, a forty-six foot median width is recommended for this project. It is quite possible that independent roadways might be desirable in the Logan area, and this possibility will be thoroughly investigated during preliminary design when more accurate mapping is available. Throughout the remainder of the project independent roadways do not appear feasible.

The A. A. S. H. O. Interstate Design Standards provide for a minimum median width of 36 feet in rural areas of flat and rolling topography. Normally, it is desirable to provide a median as wide as is economically practical.

The 46 foot median is recommended for several reasons. First of all, a 46 foot median is wide enough so that glare effects of high beam headlight operation will be minimized. If at some future date, it might be desired to plant shrubs in the median to eliminate headlight glare entirely and enhance the appearance of the median, sufficient room would be available. Second, the recommended median width provides a ditch of sufficient depth and slope to properly drain the pavement subgrade and to discourage deliberate vehicle crossings. A substantial volume of snow can be stored in a 46 foot median. If it should be desired to improve the Interstate facility at some time in the future, the recommended median would be wide enough to accommodate any of several schemes.

DRAINAGE

In order to simplify the computation of drainage costs, it has been assumed that all existing drainage structures are both adequate and necessary.

Proposed structures larger than a 72" round culvert are shown on the plans and in the cost estimate (Table 17). They have been sized to provide an area equivalent to the existing structure.

A cost per mile was developed for the smaller structures. This value was derived from the sizes and number of culverts under existing roads and railroads.

A large portion of the area lying within our study band is heavily irrigated. As a consequence, natural drainage areas have been extensively dissected. In the course of our design work, irrigation systems will be thoroughly investigated. Every attempt will be made to maintain existing drainage patterns and to provide for contemplated improvements.

COST ESTIMATES

Construction cost estimates were compiled for all route locations considered within this study. Total quantities were calculated and reasonable unit prices were assigned to the various items. Recent average low bid prices for the State of Montana were used as a guide to arrive at these values. The methods by which the quantities and their unit prices were arrived at are discussed in detail below.

Clearing and Grubbing

Areas where clearing and grubbing would be required were determined by studying the available aerial photographs and photogrammetric maps. Within the limits of the study area vegetation is sparce and generally restricted to isolated small clumps of trees. The average low bid prices compiled by the Montana State Highway Department for the year 1959 indicate a unit price of $400 per acre for the item of grubbing. Due to the sparse vegetation of the area the above unit price for grubbing was considered large enough to include clearing. Consequently, $400 an acre was used as the combined price of both clearing and grubbing.

Excavation

Earthwork quantities were computed using the Bendix G-15D digital computer. A typical roadway section, grade line, and ground elevations at increments of not more than 500 feet and at critical areas were used as input data.

The soils and geologic reconnaissance revealed three basically different materials in the study area. In the general vicinity of Logan, weakly consolidated tertiary sediments were observed over relatively competent rocks of the pretertiary age. Within the remaining portion of the study area, unconsolidated soils occur.

With respect to ease of handling during construction, the unconsolidated soils and Tertiary sediments are expected to be quite similar. The Pretertiary rocks will require drilling and blasting. However, the quantity of this type of excavation is expected to reflect only a very small percentage of the total, and consequently, it was included in the single item of unclassified excavation.

The 1959 Montana Average Low Bid Prices lists unclassified excavation as \$0.27 per cubic yard. This value was considered to be a reasonable value for the type and volume of earthwork considered in this project. To this price \$0.13 was added to provide for watering, rolling, and overhaul, making a total unit price of \$0.40 per cubic yard.

The same unit price was assigned to the item of borrow excavation since material can be obtained in the general area and would have essentially the same soil characteristics.

Pavement

Surfacing quantities were computed on the basis of typical roadway sections shown in Exhibit 3 of this report. Bituminous surfacing was used for all cross roads and frontage roads having a projected ADT exceeding 100. Gravel surfacing was used for all other cross roads and frontage roads. Determining pavement type by this criteria resulted in a proposed pavement that was generally identical to the existing surfacing.

The material quantities for bituminous surfacing, top surfacing, and base surfacing, for both roadway and shoulders, were computed using the material weights and rates of application that are standard for the State of Montana and were converted to costs per mile using the 1959 Montana Average Low Bid Prices. The same procedure was followed for reinforced concrete pavement with the exception that the unit price was reduced to \$5.50 per square yard. The 1959 Montana Average Low Bid Price of \$10.00 per square yard was considered high because it was based on only 293 square yards. The lower price was used to reflect the large increase in quantities and the local availability of Portland Cement Concrete.

Drainage

Costs of bridges serving as drainage structures are included with the Bridge Cost Estimates, Tables 11 - 13, inclusive.

Costs of culverts larger in cross-sectional area than a 72" round culvert are listed in Table 17. These costs were developed using the typical roadway sections, the contour maps, and the 1959 Montana Average Low Bid Prices.

The cost of small drainage structures (72" or less in diameter) has been calculated on a cost per mile basis. To determine the proper cost per mile to be used, eleven sections of existing highway and railroad totaling 63.9 miles were examined. The number and sizes of existing culverts were obtained. It was concluded that the proper figure to use for cost of small drainage structures was \$14,000 per mile under the proposed facility.

As unit prices have currently been less for corrugated metal culverts than reinforced concrete culverts, costs have been determined on the assumption that corrugated metal drainage structures would be used throughout the project. Ultimately, drainage structures will be compared hydraulically and economically to determine the proper facility to provide at any specific location.

Bridges

Bridge costs are shown in Tables 11 - 13, inclusive. Structure quantities were taken from final plans of similar structures furnished by the Montana State Highway Department. Current unit prices were then applied to these quantities and a unit cost per square foot of deck area was determined. The deck area is defined as the width of the structure measured between curb faces multiplied by the length of the structure from back to back of abutment walls.

Miscellaneous Items

Guardrail costs were determined assuming guardrail would be installed on all embankments exceeding ten feet in height. The unit cost for guardrail was the 1959 average low bid price.

Lighting and signing costs are included in the cost estimates. It was assumed that only the Bozeman interchange would be lighted and that all interchanges would be signed.

Unit costs used were $10, 000 per interchange for signing and $50, 000 per interchange for lighting.

Equipment passes and stock passes were placed where they were considered necessary with the aid of air photos and photogrammetric mapping. Using the 1959 bid prices the average cost per equipment pass was determined to be $16, 400 and the average price for stock passes was computed to be $9, 000.

The length of utility relocations was calculated using maps acquired from the various utility companies involved. Unit prices were based upon estimated costs supplied by the companies and upon computed figures. Listed below are the utility relocation costs used in our estimates.

Telephone and Telegraph Lines:	
Transcontinental Toll Line	$17, 500 Per Mile
Exchange or Rural Lines	1, 600 Per Mile
Power Lines:	
Rural	1, 800 Per Mile
50 KV	17, 500 Per Mile
Natural Gas Lines	$19 Per Lineal Foot
Gasoline Fuel Lines	$19 Per Lineal Foot

At Station 725, Route 1, railroad traffic would have to be maintained while the structure that would carry the C. M. St. P. & P. R. R. over I-90 is being constructed. The cost of constructing a temporary track and maintaining railroad traffic was computed to be $20,000.

Right-of-Way

Right-of-Way costs are shown in Tables 14, 15 and 16.

Land values were determined on the basis of soil types in agricultural areas. Industrial land was evaluated at $1,500 per acre. Land values were provided by the Montana Highway Department subsequent to a field reconnaissance by personnel of the right-of-way section.

In locations where a property owner has been deprived of access to a very small corner or strip of his land severance damages have been calculated as seventy five per cent of the estimated worth of the small portion of land.

The cost of severance was compared with the cost of equipment or stock passes in determining the type of treatment to be provided for any particular property. The most economical treatment was generally provided.

The values of buildings to be moved or demolished was determined by air photo interpretation and field reconnaissance.

Right-of-Way for the Interstate roadways was normally 250 feet. If a frontage road was adjacent to the Interstate roadway, the right-of-way width was increased by 75 feet.

Engineering and Contingencies

Fifteen per cent of the construction cost has been added to provide for engineering and contingencies.

Engineering items are design surveys, subsurface investigations, preparation of construction plans, special provisions, cost estimates and contract documents, bid analysis, supervision of construction, inspection of materials and workmanship, and scheduling and coordination of construction and material contracts. Included under contingencies are items uncertain as to occurance and miscellaneous minor items not included elsewhere.

ROAD-USER COSTS

Total annual road-user costs for the basic condition (existing U.S. 10) and Routes 1, 2 and 3 are shown in Tables 18 through 21 inclusive.

Road-user costs on Route 3 are the lowest of the four alternatives.

The method of calculation is as prescribed in the 1960 A.A.S.H.O. publication "Informational Report by Committee on Planning and Design Policies on Road-User Benefit Analysis for Highway Improvements". With the exception of fuel costs, all user costs are as presented in this publication. As the price of gasoline is comparatively high in Montana, a survey was conducted by personnel of the State Highway Department to determine the current retail price of gasoline in the Three Forks to Bozeman area. Fourteen service stations were contacted and prices were averaged. It was found that the average price of regular gasoline was $0.379 per gallon and premium gasoline was $0.417 per gallon. Consequently, a value of $0.40 was used throughout.

Basic traffic data used in development of road-user costs are shown in Exhibit 6. A comprehensive discussion of traffic is presented in another section of this report.

CONSTRUCTION PROCEDURE

We recommend that the proposed alignment be divided into four construction sections. The section limits and total construction cost for each section would be as follows:

Section 1 - Three Forks to Manhattan,	$4,599,500
Section 2 - Manhattan to Belgrade,	$4,167,900
Section 3 - Belgrade to the I-90-U.S. 10 Interchange,	$2,816,500
Section 4 - I-90 - U.S. 10 Interchange to East Project Limits,	$1,174,400

If desired, Sections 3 and 4 could be combined.

Under the recommended scheme Section 1 would be constructed first, and Section 4 would be the last to be built. It is anticipated that right-of-way acquisition would be the least difficult in the Three Forks to Manhattan area. After obtaining the right-of-way for this section, and while it is being built, right-of-way negotiations can be concluded in the subsequent sections.

Sections 1 through 4 have been subdivided into three separate contracts. The descriptions and values of these separate stages of construction are indicated in Table 10.

Because of the predominantly granular nature of the soil throughout the project, it is anticipated that pavement could be constructed immediately after the base courses are prepared. A decision on this matter can be made after an analysis of soil borings is completed.

TABLE 1

ECONOMIC COMPARISON OF ALTERNATE ROUTES

	Route No. 1	Route No. 2	Route No. 3
Length (Miles)	31.44	30.28	30.17
Cost:			
Construction	$13,164,800	$12,982,700	$12,758,300
Right-of-Way	761,000	1,047,300	782,400
Engineering & Contingencies	1,974,700	3,167,400*	1,913,700
Total	$15,900,500	$17,197,400	$15,454,400
Road User	9,051,100	9,224,400	8,985,700

* Includes maintenance of traffic based on detour road user costs.

TABLE 2

COST ESTIMATE

ROUTE 1

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	76	$ 400	$ 30, 400
Unclassified Excavation	Cu. Yds.	2, 201, 200	0. 40	880, 500
Borrow Excavation	Cu. Yds.	3, 271, 200	0. 40	1, 308, 500
Pavement, Shoulders and Base Courses				
4-Lane, 46' Median	Miles	30. 78	218, 400	6, 722, 400
Ramps	Miles	3. 94	22, 000	86, 700
Cross Roads - Paved	Miles	3. 61	28, 700	103, 600
Cross Roads - Gravel	Miles	0. 68	10, 000	6, 800
Frontage Roads - Gravel	Miles	8. 80	10, 000	88, 000
Temporary Connection	Miles	0. 23	43, 000	9, 900
Guardrail	Lin. Ft.	65, 000	3. 00	195, 000
Minor Drainage	Miles	31. 44	14, 000	440, 200
Major Drainage				63, 500
Structures				2, 785, 000
Stock Passes	Each	6	9, 000	54, 000
Equipment Passes	Each	5	16, 400	82, 000
Lighting and Signing				90, 000
Maintenance of RR Traffic				20, 000
Utilities				198, 300
		CONSTRUCTION COST		$13, 164,800
Right-of-Way				761,000
Engineering and Contingencies - (15% of Construction Cost)				1, 974,700
	TOTAL ESTIMATED COST			$15, 900,500

TABLE 3

COST ESTIMATE

ROUTE 2

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	48	$ 400	$ 19,200
Unclassified Excavation	Cu. Yds.	3,082,200	0.40	1,232,900
Borrow Excavation	Cu. Yds.	1,531,500	0.40	612,600
Pavement, Shoulders and Base Courses				
4-Lane, 46' Median	Miles	29.49	218,400	6,440,600
Ramps	Miles	4.03	22,000	88,700
Cross Roads - Paved	Miles	3.35	28,700	96,100
Cross Roads - Gravel	Miles	0.75	10,000	7,500
Frontage Roads - Paved	Miles	7.77	28,700	223,000
Frontage Roads - Gravel	Miles	5.83	10,000	58,300
Temporary Connection	Miles	0.23	43,000	9,900
Guardrail	Lin. Ft.	48,500	3.00	145,500
Minor Drainage	Miles	30.28	14,000	423,900
Major Drainage				101,300
Structures				3,122,300
Equipment Pass	Each	1		30,800
Lighting and Signing				90,000
Utilities				280,100
CONSTRUCTION COST				$12,982,700
Maintenance of Traffic (Detour Road User Costs)				1,220,000
Right-of-Way				1,047,300
Engineering and Contingencies (15% of Construction Cost)				1,947,400
TOTAL ESTIMATED COST				$17,197,400

TABLE 4

COST ESTIMATE

ROUTE 3

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	60	$ 400	$ 24,000
Unclassified Excavation	Cu. Yds.	2,701,000	0.40	1,080,400
Borrow Excavation	Cu. Yds.	2,679,800	0.40	1,071,900
Pavement, Shoulders and Base Courses				
4-Lane, 46' Median	Miles	29.35	218,400	6,410,000
Ramps	Miles	4.03	22,000	88,700
Cross Roads - Paved	Miles	2.66	28,700	76,300
Cross Roads - Gravel	Miles	0.30	10,000	3,000
Frontage Roads - Paved	Miles	0.51	28,700	14,600
Frontage Roads - Gravel	Miles	6.29	10,000	62,900
Temporary Connection	Miles	0.23	43,000	9,900
Guardrail	Lin. Ft.	54,200	3.00	162,600
Minor Drainage	Miles	30.17	14,000	422,400
Major Drainage				80,200
Equipment Pass	Each	1		30,800
Structures				2,960,800
I-90-N.P.R.R. - Rouse Avenue Signal				10,000
Lighting and Signing				90,000
Utilities				159,800
	CONSTRUCTION COST			$12,758,300
Right-of-Way				782,400
Engineering and Contingencies (15% of Construction Cost)				1,913,700
	TOTAL ESTIMATED COST			$15,454,400

TABLE 5

COST ESTIMATE

THREE FORKS INTERCHANGE

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	1	$ 400	$ 400
Unclassified Excavation	Cu. Yds.	7, 500	0. 40	3, 000
Borrow Excavation	Cu. Yds.	194, 000	0. 40	77, 600
Pavement, Shoulders and Base Courses				
4-Lane, 46' Median	Miles	0. 68	218, 400	148, 500
Ramps	Miles	0. 98	22, 000	21, 600
Cross Roads - Paved	Miles	0. 59	28, 700	16, 900
Cross Roads - Gravel	Miles	0. 25	10, 000	2, 500
Guardrail	Lin. Ft.	10, 020	3. 00	30, 100
Minor Drainage	Miles	0. 68	14, 000	9, 500
Structures				74, 600
Lighting and Signing				10, 000
Utilities				100
	CONSTRUCTION COST			$ 394, 800
Right-of-Way				43, 300
Engineering and Contingencies (15% of Construction Cost)				59, 200
	TOTAL ESTIMATED COST			$ 497, 300

TABLE 6

COST ESTIMATE

ROUTE 3 -- SECTION 1

Sta. 126+00 to Sta. 666+00

Length 10.23 Miles

(Includes Relocated F. A. S. 288)

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	24	$ 400	$ 9,600
Unclassified Excavation	Cu. Yds.	2,135,500	0.40	854,200
Pavement				
4-Lane, 46' Median	Miles	9.77	166,200	1,623,800
Temp. Connection with U.S. 10	Miles	0.23	20,700	4,800
Ramps	Miles	1.48	10,400	15,400
Cross Roads and Frontage Roads (Paved)	Miles	2.02	13,800	27,900
Top and Base Surfacing				
4-Lane, 46' Median	Miles	9.77	52,200	510,000
Temp. Connection with U.S. 10	Miles	0.23	22,300	5,100
Ramps	Miles	1.48	11,600	17,200
Cross Roads and Frontage Roads (Paved)	Miles	2.02	14,900	30,100
Cross Roads and Frontage Roads (Gravel)	Miles	2.90	10,000	29,000
Guardrail	Lin. Ft.	19,100	3.00	57,300
Minor Drainage	Miles	10.23	14,000	143,200
Major Drainage	See Table 17			28,700
Structures	See Table 13			1,144,300
Equipment Pass				30,800
Lighting and Signing				20,000
Utilities				48,100
	CONSTRUCTION COST			$ 4,599,500
Right-of-Way				154,200
Engineering and Contingencies	(15% of Construction Cost)			685,300
	TOTAL ESTIMATED COST			$ 5,443,600

TABLE 7

COST ESTIMATE

ROUTE 3 -- SECTION 2

Sta. 666+00 to Sta. 1169+00

Length 9.53 Miles

(Includes F.A.S. 291)

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	24	$ 400	$ 9,600
Unclassified Excavation	Cu. Yds.	240,000	0.40	96,000
Borrow Excavation	Cu. Yds.	1,591,400	0.40	636,600
Pavement				
4-Lane, 46' Median	Miles	0.31	166,200	1,547,300
Ramps	Miles	0.98	10,400	10,200
Cross Roads and Frontage Roads - Paved	Miles	0.85	13,800	11,700
Top and Base Surfacing				
4-Lane, 46' Median	Miles	9.31	52,200	486,000
Ramps	Miles	0.98	11,600	11,400
Cross Roads and Frontage Roads - Paved	Miles	0.85	14,900	12,600
Cross Roads and Frontage Roads - Gravel	Miles	0.30	10,000	3,000
Guardrail	Lin. Ft.	23,500	3.00	70,500
Minor Drainage	Miles	9.53	14,000	133,400
Structures	See Table 13			1,103,600
Lighting and Signing				10,000
Utilities				26,000
	CONSTRUCTION COST			$ 4,167,900
Right-of-Way				181,700
Engineering and Contingencies	(15% of Construction Cost)			625,200
	TOTAL ESTIMATED COST			$ 4,974,800

TABLE 8

COST ESTIMATE

ROUTE 3 -- SECTION 3

Sta. 1169+00 to Sta. 1638+00

Length 8.88 Miles

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	3	$ 400	$ 1,200
Unclassified Excavation	Cu. Yds.	295,500	0.40	118,200
Borrow Excavation	Cu. Yds.	367,000	0.40	146,800
Pavement				
4-Lane, 46' Median	Miles	8.84	166,200	1,469,200
Ramps	Miles	1.57	10,400	16,300
Cross Roads and Frontage Roads - Paved	Miles	0.30	13,800	4,100
Top and Base Surfacing				
4-Lane, 46' Median	Miles	8.84	52,200	461,400
Ramps	Miles	1.57	11,600	18,200
Cross Roads and Frontage Roads - Paved	Miles	0.30	14,900	4,500
Cross Roads and Frontage Roads - Gravel	Miles	2.77	10,000	27,700
Guardrail	Lin. Ft.	4,500	3.00	13,500
Minor Drainage	Miles	8.88	14,000	124,300
Major Drainage	See Table 17			51,500
Structures	See Table 13			241,300
Lighting and Signing				60,000
Utilities				58,300
	CONSTRUCTION COST			$ 2,816,500
Right-of-Way				314,300
Engineering and Contingencies	(15% of Construction Cost)			422,500
	TOTAL ESTIMATED COST			$ 3,553,300

TABLE 9

COST ESTIMATE

ROUTE 3 -- SECTION 4

Sta. 1638+00 to Sta. 1719+00

Length 1.53 Miles

Item	Unit	Quantity	Unit Price	Cost
Clearing and Grubbing	Acres	9	$ 400	$ 3,600
Unclassified Excavation	Cu. Yds.	30,000	0.40	12,000
Borrow Excavation	Cu. Yds.	721,400	0.40	288,500
Pavement				
4-Lane, 46' Median	Miles	1.43	166,200	237,700
Top and Base Surfacing				
4-Lane, 46' Median	Miles	1.43	52,200	74,600
Cross Roads and Frontage Roads - Gravel	Miles	0.62	10,000	6,200
Guardrail	Lin. Ft.	7,100	3.00	21,300
Minor Drainage	Miles	1.53	14,000	21,500
Structures	See Table 13			471,600
I-90 - N.P.R.R. - Rouse Avenue Signal	Each	1	10,000	10,000
Utilities				27,400
	CONSTRUCTION COST			$ 1,174,400
Right-of-Way				132,200
Engineering and Contingencies (15% of Construction Cost)				176,100
	TOTAL ESTIMATED COST			$ 1,482,700

TABLE 10

STAGE CONSTRUCTION

ROUTE 3 -- SECTIONS 1 - 4

Contract	Section 1	Section 2	Section 3	Section 4	Totals
1. Clearing, Grubbing, Excavation, Drainage, Base Courses and Utilities	$1, 706, 000	$1, 414, 600	$1, 012, 100	$ 443, 800	$4, 576, 500
2. Pavement, Guardrail, Lighting and Signing	1, 749, 200	1, 649, 700	1, 563, 100	259, 000	5, 221, 000
3. Structures	1, 144, 300	1, 103, 600	241, 300	471, 600	2, 960, 800
TOTAL CONSTRUCTION COST	$4, 599, 500	$4, 167, 900	$2, 816, 500	$1, 174, 400	$12, 758, 300

TABLE 11

BRIDGE COSTS

ROUTE 1

Station	Length (Feet)	Deck Width (Feet)	Deck Area (Sq. Ft.)	Cost Per Sq. Ft.	Cost
648+40	210	76	15,960	$ 11.00	$ 175,600
725+20	241	(Estimated cost per Lin. Foot =		833.20)	200,800
855+70	219	28	6,130	11.00	67,400
972+00	250	76	19,000	14.50	275,500
1040+00	243	28	6,800	11.00	74,800
1163+80	386	24	9,260	11.00	101,900
1370+20	222	28	6,220	11.00	68,400
1575+20	213	24	5,110	11.00	56,200
1756+10	80	76	6,080	11.00	66,900
1775+70	341	28	9,550	11.00	105,000
1854+30	80	76	6,080	11.00	66,900
1874+30	210	28	5,880	11.00	64,700
1935+50	154	76	11,700	11.00	128,700*
1951+20	185	76	14,060	11.00	154,700*
1959+10	120	76	9,120	11.00	100,300*
Structures Common to Routes 1 and 3					1,077,200
TOTAL ESTIMATED COST OF BRIDGES					$2,785,000

* Structures Common to Routes 1 and 2

TABLE 12

BRIDGE COSTS

ROUTE 2

Station	Length (Feet)	Deck Width (Feet)	Deck Area (Sq. Ft.)	Cost Per Sq. Ft.	Cost
987+90	319	56	17,860	$ 11.00	$ 196,500
1031+40	70	76	5,320	11.00	58,500
1031+40	70	28	1,960	11.00	21,600
1041+50	84	76	6,380	11.00	70,200
1041+50	84	28	2,350	11.00	25,800
1074+00	148	76	11,250	11.00	123,800
1117+50	250	76	19,000	14.50	275,500
1117+50	250	28	7,000	14.50	101,500
1161+00	118	76	8,970	11.00	98,700
1420+00	222	28	6,220	11.00	68,400
1614+70	393	24	9,430	11.00	103,700
1746+90	393	24	9,430	11.00	103,700
1861+50	272	28	7,620	11.00	83,800
Structures Common to Routes 2 and 3					1,406,900
Structures Common to Routes 1 and 2					383,700
TOTAL ESTIMATED COST OF BRIDGES					$ 3,122,300

TABLE 13

BRIDGE COSTS

ROUTE 3

Station	Length (Feet)	Deck Width (Feet)	Deck Area (Sq. Ft.)	Cost Per Sq. Ft.	Cost
148+40	700	56	39,200	$ 14.80	$ 580,200*
185+50	100	76	7,600	11.00	83,600*
213+50	80	76	6,080	11.00	66,900*
213+50	80	24	1,920	11.00	21,100*
228+80	121	76	9,200	11.00	101,200*
252+40	80	76	6,080	11.00	66,900*
252+40	80	24	1,920	11.00	21,100*
380+30	139	76	10,560	11.00	116,200*
380+30	Alterations to Railroad Trestle				20,000*
655+30	218	28	6,100	11.00	67,100**
684+40	166	76	12,620	11.00	138,800**
698+20	148	76	11,250	11.00	123,800**
774+70	70	76	5,320	11.00	58,500
787+00	84	76	6,380	11.00	70,200
821+80	148	76	11,250	11.00	123,800
863+60	250	76	19,000	14.50	275,500
909+00	122	76	9,270	11.00	102,000
1120+00	154	76	11,700	11.00	128,700
1168+00	267	28	7,480	11.00	82,300
1451+50	192	76	14,590	11.00	160,500
1624+50	230	28	6,440	11.00	70,800
1624+50	Removal of Existing Structure				10,000
1664+40	250	76	19,000	11.00	209,000
1675+70	193	76	14,670	11.00	161,400
1683+80	121	76	9,200	11.00	101,200
			TOTAL COST OF BRIDGES		$ 2,960,800

* Structures Common to Routes 1, 2 and 3

** Structures Common to Routes 2 and 3

TABLE 14

RIGHT-OF-WAY COSTS

ROUTE 1

Station	to	Station	Acreage	Value Per Acre	Cost
609+00		661+00	32.2	$ 100	$ 3,220
661+00		684+00	13.2	300	3,960
684+00		732+00	27.5	200	5,500
732+00		800+00	39.0	300	11,700
800+00		843+00	32.6	100	3,260
843+00		875+00	39.7	300	11,910
875+00		900+00	17.9	100	1,790
900+00		932+00	18.4	200	3,680
932+00		962+00	16.6	300	4,980
962+00		1015+00	30.4	100	3,040
1015+00		1053+00	30.8	250	7,700
1053+00		1117+00	36.1	350	12,640
1117+00		1150+00	23.6	250	5,900
1150+00		1316+00	99.8	350	34,930
1316+00		1402+00	90.3	450	40,640
1402+00		1428+00	14.9	350	5,220
1428+00		1494+00	37.9	450	17,060
1494+00		1543+00	28.1	400	11,240
1543+00		1686+00	87.6	450	39,420
1686+00		1804+00	63.1	300	18,930
1804+00		1860+00	36.8	350	12,880
1860+00		1966+20	83.6	1,500	125,400
1690+60		1719+00	21.2	1,500	31,800
Right-of-Way Common to Routes1 and 3-			172.1		23,570
Total Interstate Right-of-Way			1093.4		440,370
Severance			238.1		60,630
Buildings					260,000
		TOTAL ESTIMATED RIGHT-OF-WAY COST			$ 761,000

TABLE 15

RIGHT-OF-WAY COSTS

ROUTE 2

Station	to	Station	Acreage	Value Per Acre	Cost
965+80		1017+00	28.1	$ 300	$ 8,430
1017+00		1044+00	15.6	100	1,560
1044+00		1052+00	6.7	300	2,010
1052+00		1077+00	15.1	100	1,510
1077+00		1095+00	7.4	400	2,960
1095+00		1120+00	13.6	100	1,360
1120+00		1188+00	41.5	400	16,600
1188+00		1231+00	21.9	450	9,860
1231+00		1550+00	179.6	350	62,860
1550+00		1620+00	39.0	450	17,550
1620+00		1635+00	8.3	1,000	8,300
1635+00		1664+00	7.1	450	3,200
1664+00		1845+00	89.9	1,000	89,900
1845+00		1904+70	47.8	1,500	71,700
1919+50		1966+20	28.8	1,500	43,200
1690+60		1719+00	21.2	1,500	31,800
Right-of-Way Common to Routes 2 and 3			384.2		78,590
Total Interstate Right-of-Way			955.8		451,390
Severance			65.6		7,510
Buildings					580,000
Removal of Existing Signs (U.S. 10)					8,400
TOTAL ESTIMATED RIGHT-OF-WAY COST					$ 1,047,300

TABLE 16

RIGHT-OF-WAY COSTS

ROUTE 3

Station	to	Station	Acreage	Value Per Acre	Cost
126+00		304+00	111.7	$ 100	$ 11,170*
304+00		344+00	21.5	300	6,450*
344+00		385+00	28.6	100	2,860*
385+00		400+30	10.3	300	3,090*
400+30		437+00	21.8	100	2,180**
437+00		471+00	19.5	300	5,850**
471+00		545+00	42.5	200	8,500**
545+00		711+00	128.3	300	38,490**
711+00		764+00	31.0	300	9,300
764+00		789+00	14.4	100	1,440
789+00		802+00	6.9	300	2,070
802+00		825+00	11.5	100	1,150
825+00		844+00	12.6	400	5,040
844+00		874+00	17.5	100	1,750
874+00		930+00	33.2	400	13,280
930+00		974+00	25.3	450	11,390
974+00		1271+00	205.6	350	71,960
1271+00		1350+00	45.8	450	20,610
1350+00		1367+00	9.2	1,000	9,200
1367+00		1395+00	5.7	450	2,570
1395+00		1595+00	133.7	1,000	133,700
1595+00		1719+00	94.1	1,500	141,150
Total Interstate Right-of-Way			1,030.7		503,200
Severance			105.0		24,200
Buildings					255,000
TOTAL ESTIMATED RIGHT-OF-WAY					$ 782,400

* Common to Routes 1, 2 and 3
** Common to Routes 2 and 3

TABLE 17

DRAINAGE COSTS

ROUTE 1

Station	Culvert Size	Cost
672+50	9'- 6" x 6'-5"	$ 16,500
736+00	12'-10" x 8'-4"	21,500
1514+00	Twin 9'- 6" x 6'-5"	25,500
	TOTALS	$ 63,500

ROUTE 2

Station	Culvert Size	Cost
1587+00	Twin 7'-3" x 5'-3"	$ 17,000
1587+00 F.R.	Twin 7'-3" x 5'-3"	5,000
1587+00 F.R.	Twin 7'-3" x 5'-3"	5,000
1603+00	Twin 7'-0" x 5'-1"	15,800
1603+00 F.R.	Twin 7'-0" x 5'-1"	4,500
1603+00 F.R.	Twin 7'-0" x 5'-1"	4,500
1781+00	Twin 6'-1" x 6'-7"	16,000
1781+00 F.R.	Twin 6'-1" x 4'-7"	4,800
Drainage Common to both Routes 2 and 3		28,700
	TOTALS	$101,300

ROUTE 3

Station	Culvert Size	Cost
469+00	108"	$ 19,400*
516+00	7'-3" x 5'-3"	9,300*
1315+50	Twin 7'-3" x 5'-3"	16,600
1334+00	Twin 7'-0" x 5'-1"	14,900
1511+00	Twin 6'-1" x 4'-7"	20,000
	TOTALS	$ 80,200

* Common to Routes 2 and 3

TABLE 18

ROAD USER COSTS

BASIC CONDITION

EXISTING U. S. 10

Location	% Grade Class	Length (Miles)	Type of Operation	Running Speed MPH	1975 A. D. T.	Equiv. Pass. Cars	R. U. C. Per Veh. Mile	Annual Road User Costs
U. S. 10 (2 Lanes)								
Beginning of Project to Trident Road	0 - 3	1. 8	R	40	4, 486	6, 168	. 1105	$ 447, 800
Trident Road to Logan	0 - 3	3. 2	R	40	4, 347	5, 977	. 1105	771, 400
Logan to Manhattan	0 - 3	4. 8	R	40	4, 441	6, 106	. 1105	1, 182, 100
	3 - 5	0. 7	R	40	4, 441	6, 106	. 1127	175, 800
	5 - 7	0. 2	R	40	4, 441	6, 106	. 1159	51, 700
Manhattan to Belgrade	0 - 3	9. 2	R	40	4, 945	6, 799	. 1105	2, 522, 800
	3 - 5	0. 2	R	40	4, 945	6, 799	. 1127	55, 900
Belgrade to Bozeman City Limits	0 - 3	8. 6	R	32	6, 284	8, 641	. 1132	3, 070, 500
	3 - 5	0. 2	R	32	6, 284	8, 641	. 1146	72, 300
	5 - 7	0. 1	R	32	6, 284	8, 641	. 1166	36, 800
Bozeman City Limits to Bozeman	0 - 3	1. 5	R	30	6, 284	8, 641	. 1161	549, 200
								$ 8, 936, 300
				Additional Cost for Stops				284, 800
				TOTAL ANNUAL ROAD USER COSTS				$ 9, 221, 100

TABLE 19

ROAD USER COSTS

ROUTE 1

Location	% Grade Class	Length (Miles)	Type of Operation	Running Speed MPH	1975 A. D. T.	Equiv. Pass. Cars	R. U. C. Per Veh. Mile	Annual Road User Costs
I-90 (4 Lanes)								
Beginning of Project to Logan Inter.	0 - 3	4.9	F	60	4,503	6,192	.0977	$ 1,082,000
Logan Inter. to Manhattan Inter.	0 - 3	5.1	F	60	4,611	6,340	.0977	1,153,000
Manhattan Inter. to Belgrade Inter.	0 - 3	9.7	F	60	4,663	6,412	.0977	2,218,000
Belgrade Inter. to Bozeman Inter.	0 - 3	9.5	F	60	4,549	6,255	.0977	2,119,000
Bozeman Inter. to End of Project	0 - 3	2.3	F	60	1,391	1,913	.0977	156,900
U.S. 10 (2 Lanes)								
Beginning of Project to Trident Road	0 - 3	1.8	F	45	448	616	.0948	38,400
Trident Road to Logan	0 - 3	3.2	F	45	274	377	.0948	41,700
Logan to Manhattan	0 - 3	4.8	F	45	342	470	.0948	78,100
	3 - 5	0.7	F	45	342	470	.0970	11,600
	5 - 7	0.2	F	45	342	470	.1006	3,500
Manhattan to Belgrade	0 - 3	9.2	F	45	695	956	.0948	304,300
	3 - 5	0.2	F	45	695	956	.0970	6,800
Belgrade to Bozeman Interchange	0 - 3	7.7	F	45	1,801	2,476	.0948	659,700
	3 - 5	0.1	F	45	1,801	2,476	.0970	8,800
	5 - 7	0.1	F	45	1,801	2,476	.1006	9,100
Bozeman Inter. to Bozeman	0 - 3	2.3	R	30	4,959	6,819	.1161	664,600
	3 - 5	0.2	R	30	4,959	6,819	.1174	58,400
Interchange Conn.								
U.S. 10 to Logan Inter.	0 - 3	0.2	F	40	404	556	.0958	3,900
U.S. 10 to Manhattan Inter.	0 - 3	1.8	F	40	1,306	1,796	.0958	113,000
U.S. 10 to Belgrade Inter.	0 - 3	2.5	F	40	1,162	1,598	.0958	139,700
								$8,870,500
				Additional Cost for Stops				180,600
				TOTAL ANNUAL ROAD USER COSTS				$9,051,100

TABLE 20

ROAD USER COSTS

ROUTE 2

Location	% Grade Class	Length (Miles)	Type of Operation	Running Speed MPH	1975 A. D. T.	Equiv. Pass. Cars	R. U. C. Per Veh. Mile	Annual Road User Costs
I-90 (4 Lanes)								
Beginning of Project to Logan Inter.	0 - 3	4.9	F	60	4,594	6,317	.0977	$ 1,103,800
Logan Inter. to Manhattan Inter.	0 - 3	5.4	F	60	4,771	6,560	.0977	1,263,200
Manhattan Inter. to Belgrade Inter.	0 - 3	9.5	F	60	5,204	7,156	.0977	2,424,300
Belgrade Inter. to Bozeman Inter.	0 - 3	8.4	F	60	5,905	8,119	.0977	2,432,000
Bozeman Inter. to End of Project	0 - 3	2.3	F	60	1,391	1,913	.0977	156,900
U. S. 10, Front. Rds. and Local Rds.								
Beginning of Project to Trident Road	0 - 3	1.8	F	45	388	534	.0948	33,300
Trident Road to Logan	0 - 3	3.2	F	45	217	298	.0948	33,000
Logan to Manhattan	0 - 3	4.8	F	45	236	325	.0948	54,000
	3 - 5	0.7	F	45	236	325	.0970	8,100
	5 - 7	0.2	F	45	236	325	.1006	2,400
Manhattan to Belgrade	0 - 3	10.6	F	45	334	459	.0948	168,400
	3 - 5	0.2	F	45	334	459	.0970	3,300
Belgrade to Bozeman Interchange	0 - 3	9.7	F	45	897	1,233	.0948	413,800
	3 - 5	0.2	F	45	897	1,233	.0970	8,700
	5 - 7	0.1	F	45	897	1,233	.1006	4,500
Bozeman Interchange to Bozeman	0 - 3	2.3	R	30	5,411	7,440	.1161	725,100
	3 - 5	0.2	R	30	5,411	7,440	.1174	63,800
Interchange Conn.								
U. S. 10 to Logan Inter.	0 - 3	0.2	F	40	472	649	.0958	4,500
U. S. 10 to Manhattan Inter.	0 - 3	0.6	F	40	1,904	2,618	.0958	54,900
U. S. 10 to Belgrade Inter.	0 - 3	0.7	F	40	2,548	3,504	.0958	85,800
								$ 9,043,800
				Additional Cost for Stops				180,600
				TOTAL ANNUAL ROAD USER COSTS				$ 9,224,400

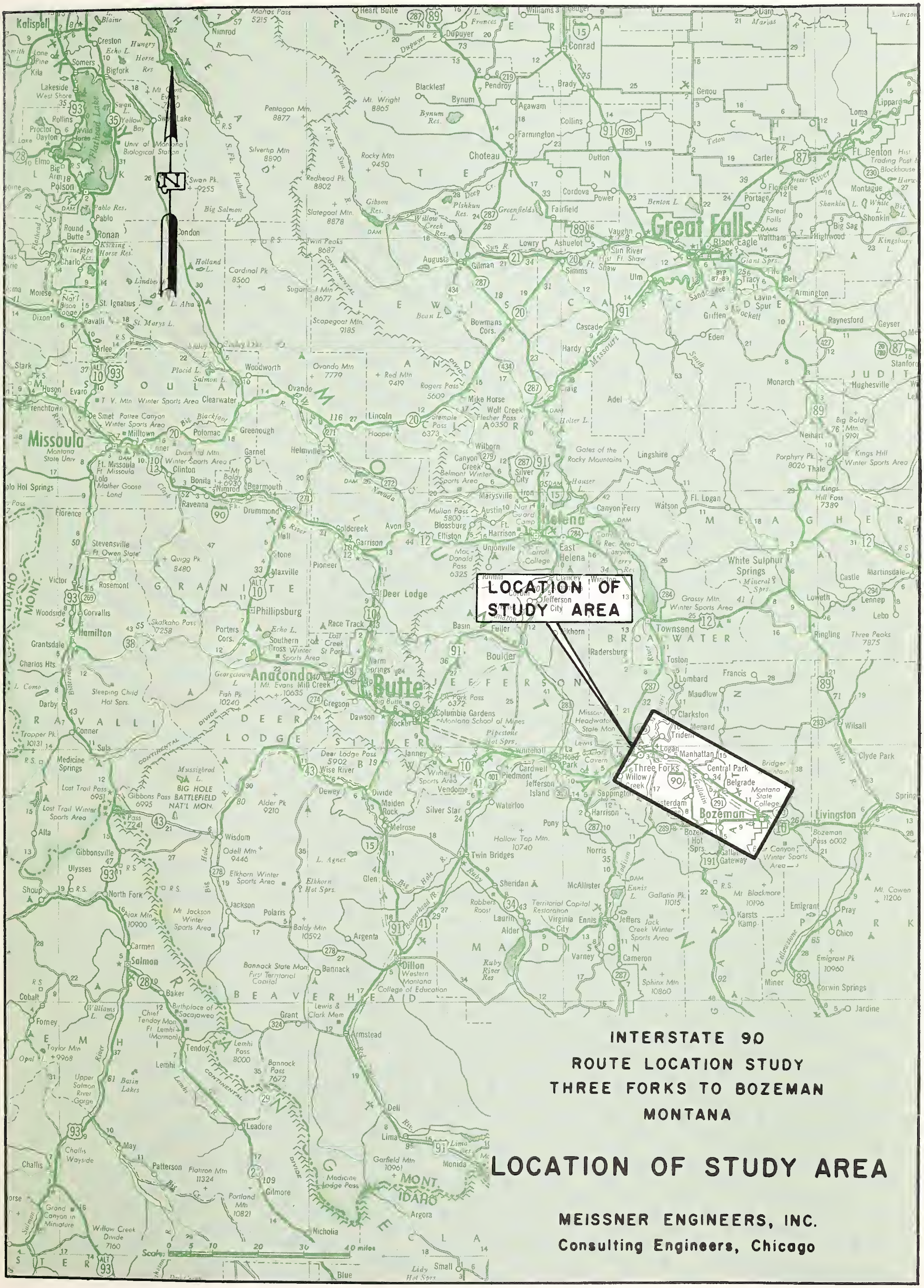
TABLE 21

ROAD USER COSTS

ROUTE 3

Location	% Grade Class	Length (Miles)	Type of Operation	Running Speed MPH	1975 A. D. T.	Equiv. Pass. Cars	R. U. C. Per Veh. Mile	Annual Road User Costs
I-90 (4 Lanes)								
Beginning of Project to Logan Inter.	0 - 3	4.9	F	60	4,594	6,317	.0977	$ 1,103,800
Logan Inter. to Manhattan Inter.	0 - 3	5.4	F	60	4,771	6,560	.0977	1,263,200
Manhattan Inter. to Belgrade Inter.	0 - 3	9.5	F	60	5,204	7,156	.0977	2,424,300
Belgrade Inter. to Bozeman Inter.	0 - 3	8.7	F	60	5,905	8,119	.0977	2,518,900
Bozeman Inter. to End of Project	0 - 3	1.8	F	60	1,391	1,913	.0977	122,800
U. S. 10 (2 Lanes)								
Beginning of Project to Trident Road	0 - 3	1.8	F	45	388	534	.0948	33,300
Trident Road to Logan	0 - 3	3.2	F	45	217	298	.0948	33,000
Logan to Manhattan	0 - 3	4.8	F	45	236	325	.0948	54,000
	3 - 5	0.7	F	45	236	325	.0970	8,100
	5 - 7	0.2	F	45	236	325	.1006	2,400
Manhattan to Belgrade	0 - 3	9.2	F	45	334	459	.0948	146,100
	3 - 5	0.2	F	45	334	459	.0970	3,200
Belgrade to Bozeman Inter.	0 - 3	8.4	F	45	897	1,233	.0948	358,400
	3 - 5	0.2	F	45	897	1,233	.0970	8,700
Bozeman Inter. to Bozeman	0 - 3	1.8	R	30	5,411	7,440	.1161	567,500
Interchange Conn.								
U. S. 10 to Logan Inter.	0 - 3	0.2	F	40	472	649	.0958	4,500
U. S. 10 to Manhattan Inter.	0 - 3	0.6	F	40	1,904	2,618	.0958	54,900
U. S. 10 to Belgrade Inter.	0 - 3	0.8	F	40	2,548	3,504	.0958	98,000
								$ 8,805,100
				Additional Cost for Stops				180,600
				TOTAL ANNUAL ROAD USER COSTS				$ 8,985,700

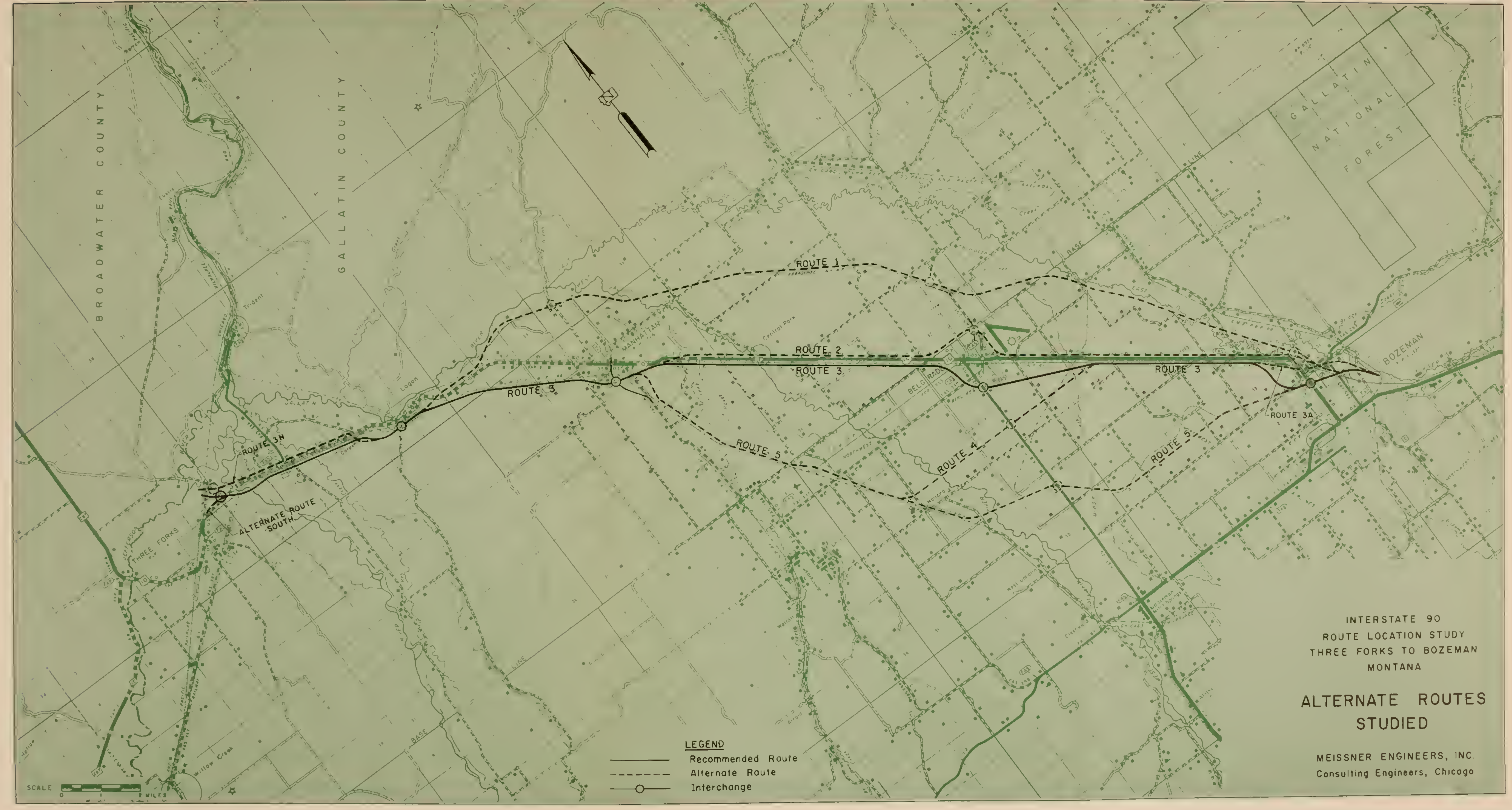
EXHIBIT I



INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

LOCATION OF STUDY AREA

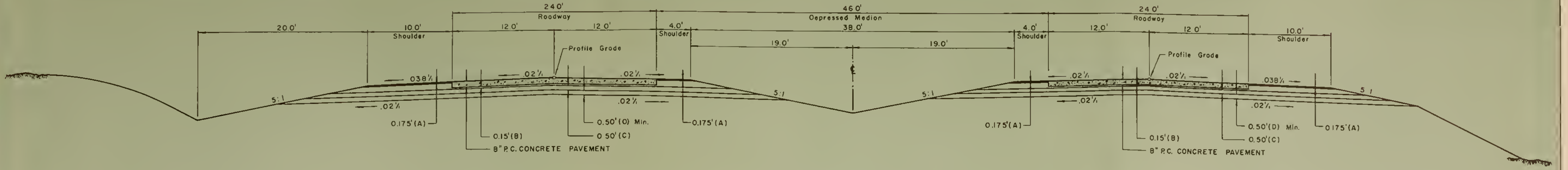
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago



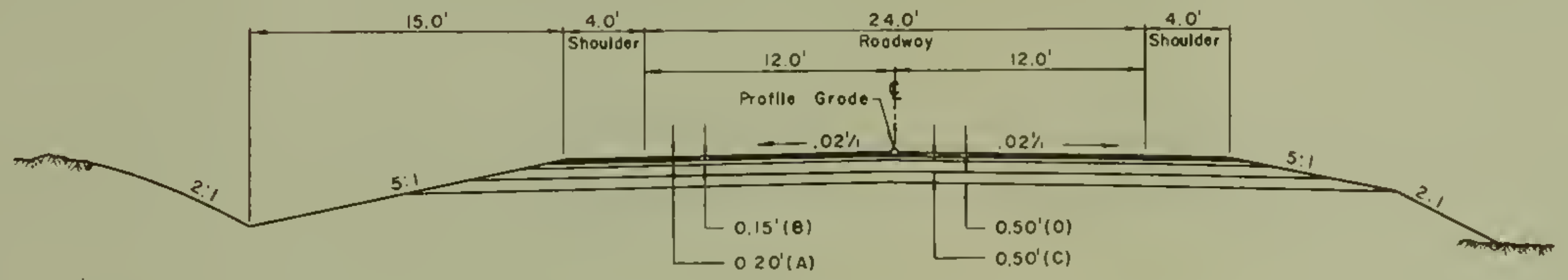
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

ALTERNATE ROUTES STUDIED

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

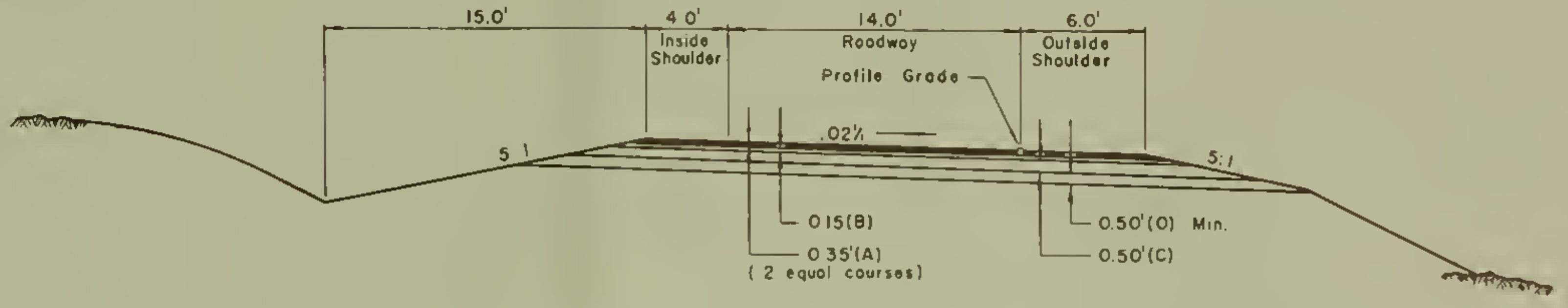


MAIN ROADWAY

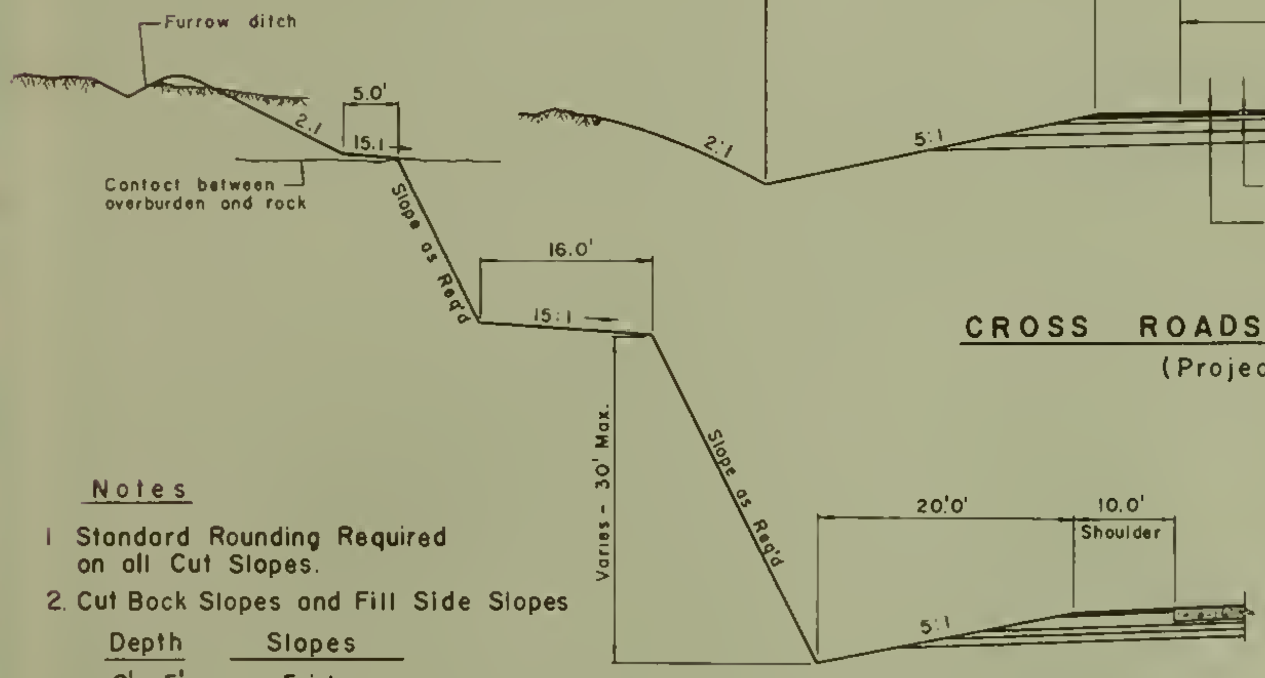


CROSS ROADS AND FRONTAGE ROADS

(Projected A.D.T. over 100)

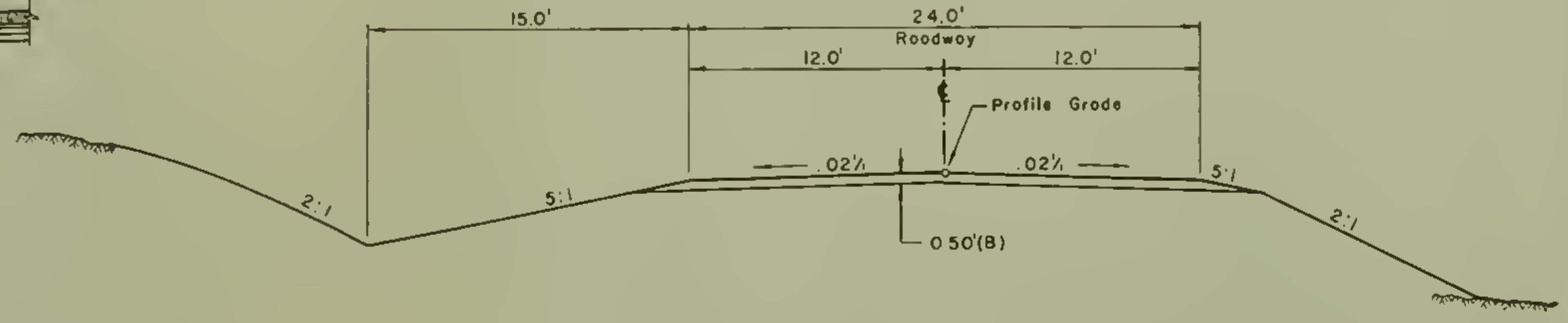


RAMPS



BENCH IN ROCK CUT

No Scale



CROSS ROADS AND FRONTAGE ROADS

(Projected A.D.T. under 100)

Notes

1. Standard Rounding Required on all Cut Slopes.
2. Cut Back Slopes and Fill Side Slopes

Depth	Slopes
0'- 5'	5 : 1
5'-10'	4 : 1
10'-15'	3 : 1
over 15'	2 : 1

3. Superelevation on Curves Required as Per A.A.S.H.O. Standards - Maximum 0.08'/'
4. Prime, Seal, and Cover Aggregate Required full width of all Bituminous Surfacing.

A = Compacted Plant Mix Bituminous Surfacing, Type II

B = Compacted Crushed Top Surfacing, Type "A", Grade 2

C = Compacted Crushed Base Surfacing, Type "A", Grade 5

D = Compacted Crushed Base Surfacing, Type "A", Grade 1

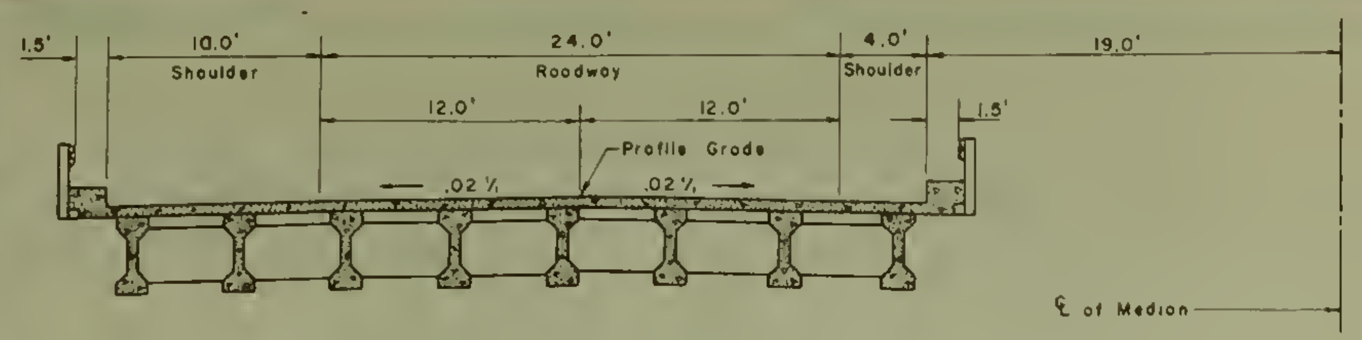
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

ROADWAY TYPICAL SECTIONS

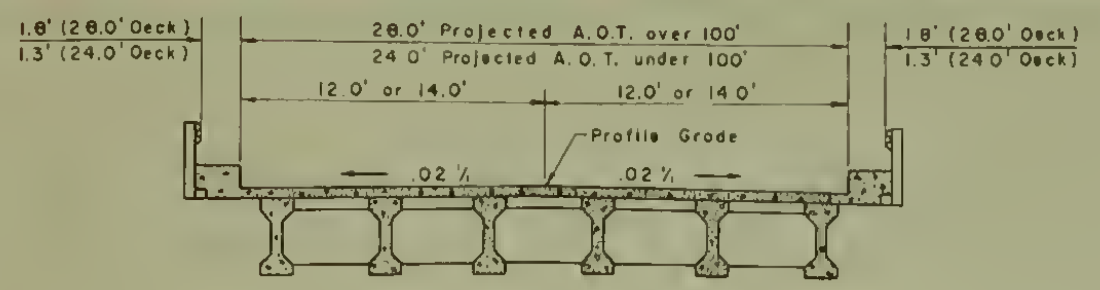
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

SCALE

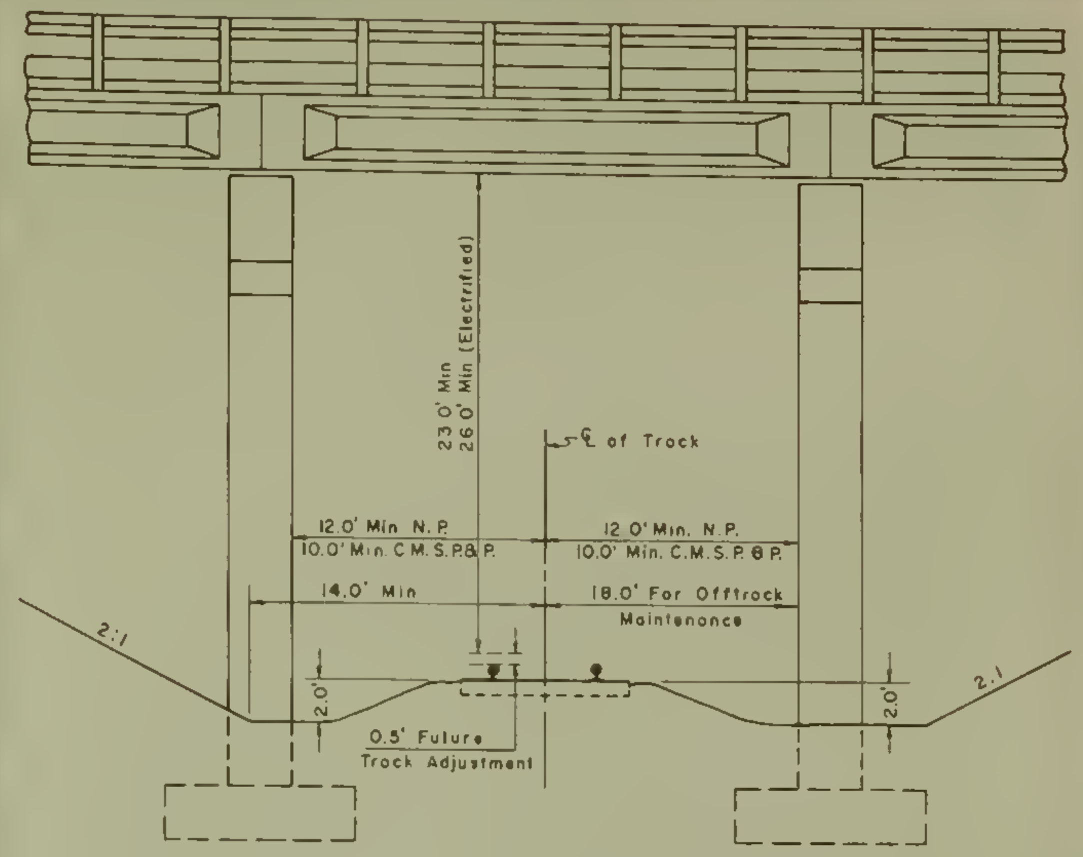
10 Feet 0 10 Feet



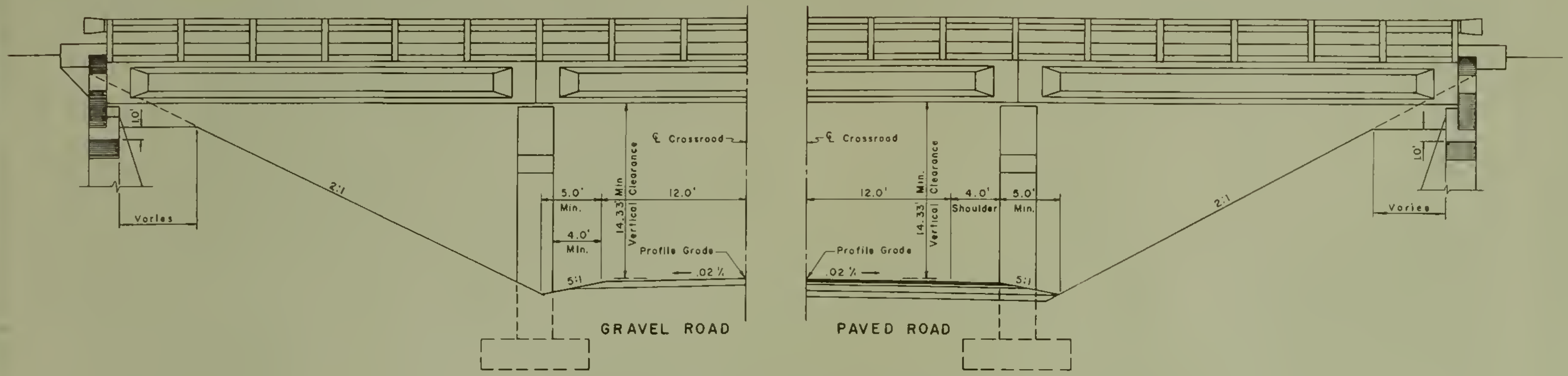
HALF SECTION – INTERSTATE OVERPASS



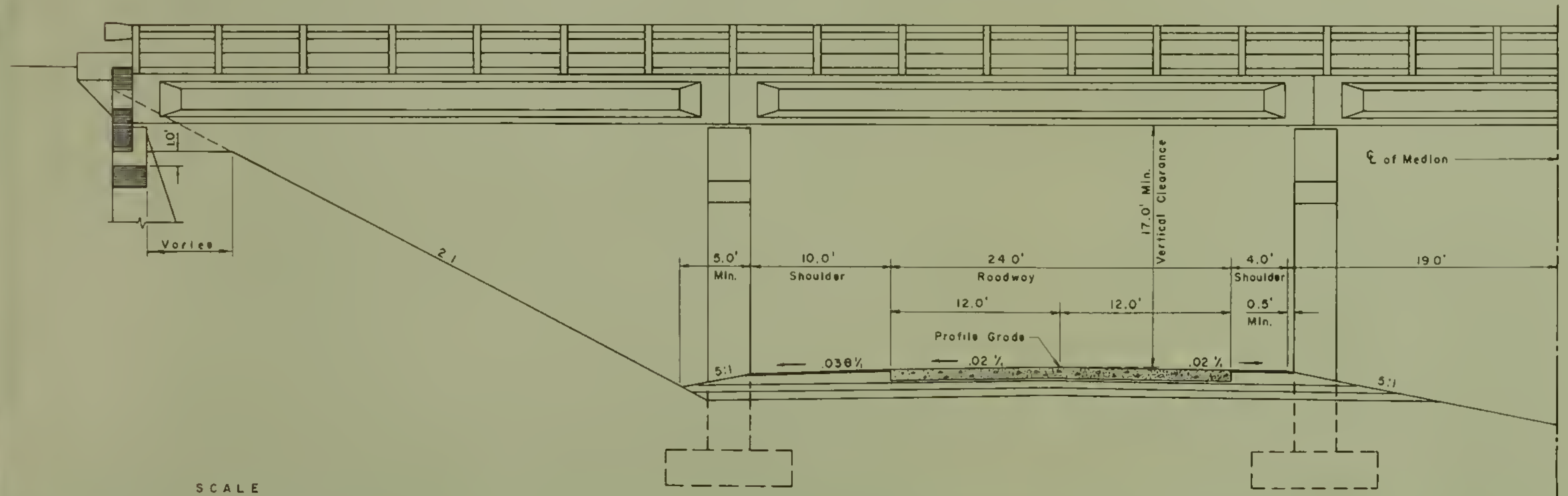
TYICAL SECTION – CROSSROAD & FRONTAGE ROAD OVERPASS

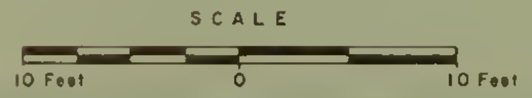


TYPICAL SECTION – RAILROAD UNDERPASS



HALF SECTIONS – CROSSROAD UNDERPASS





HALF SECTION – INTERSTATE UNDERPASS

Notes

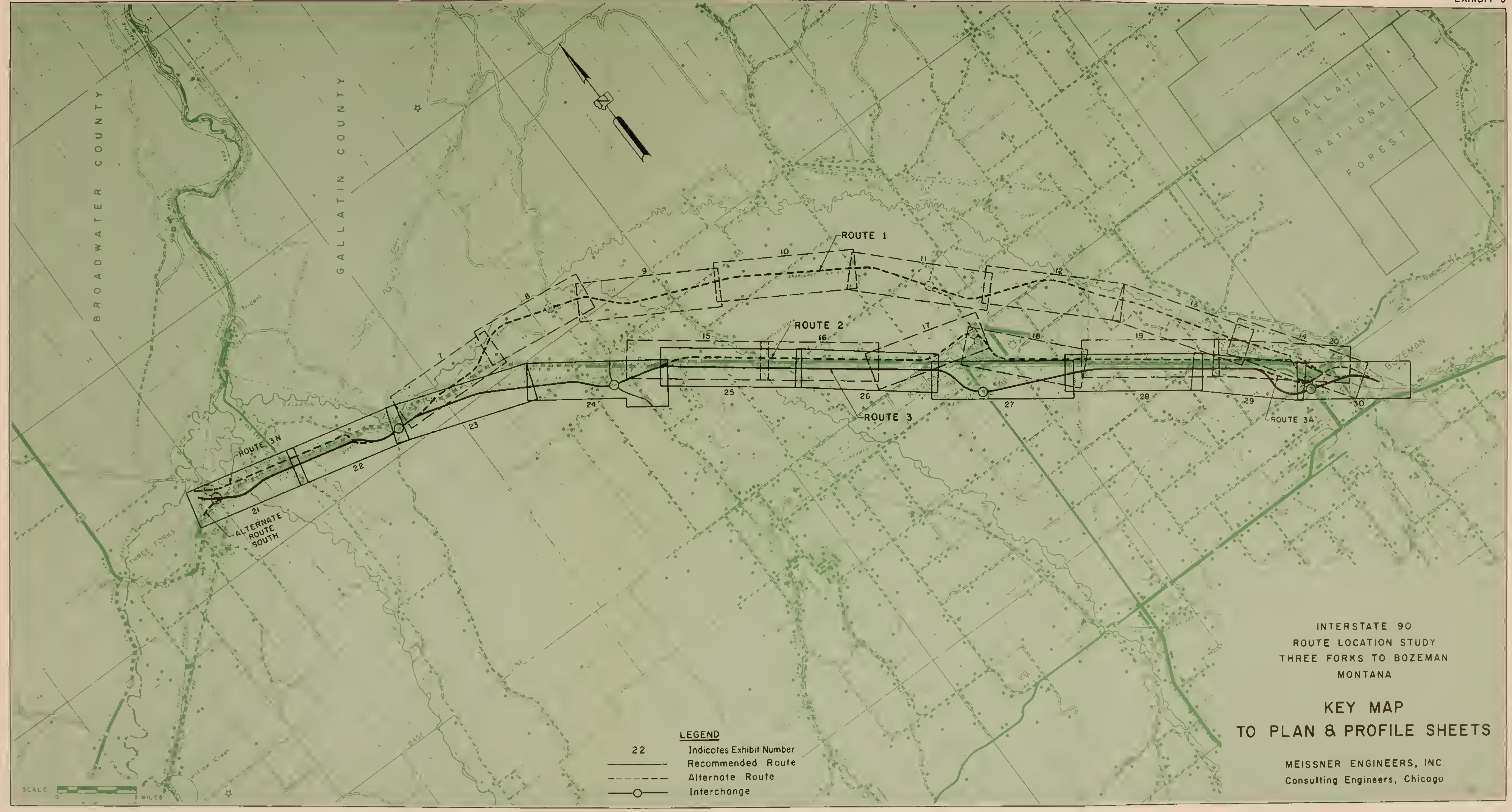
1. The bridge beam depths, spacings and types shown are for illustrative purposes only.
2. For Interstate overpass structures having a rail length of 250' or less between abutments, use shoulder and curb widths as shown.
3. For Interstate overpass structures having a rail length over 250' between abutments, use 2' shoulder width and 1.8' curb width.

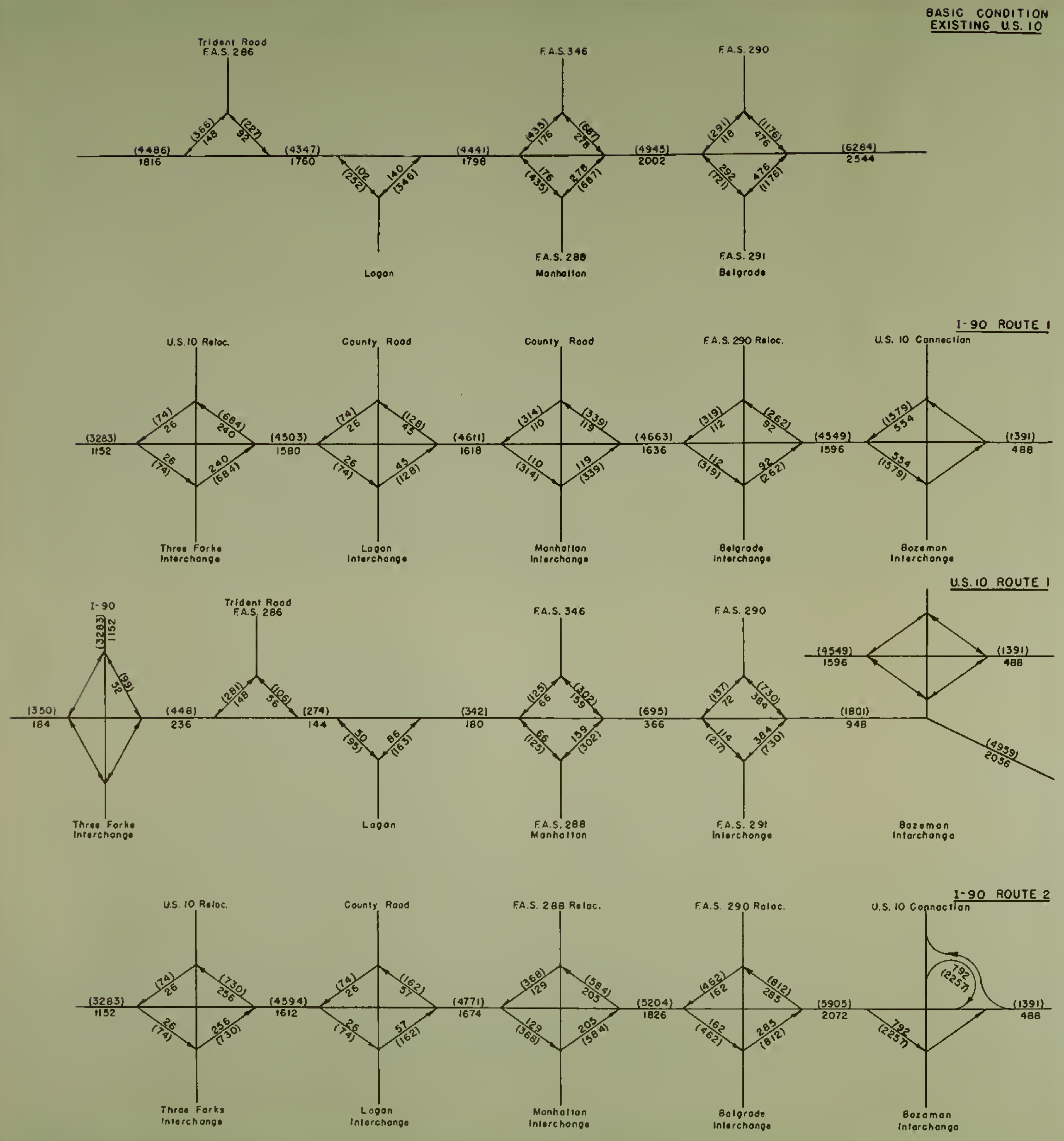
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

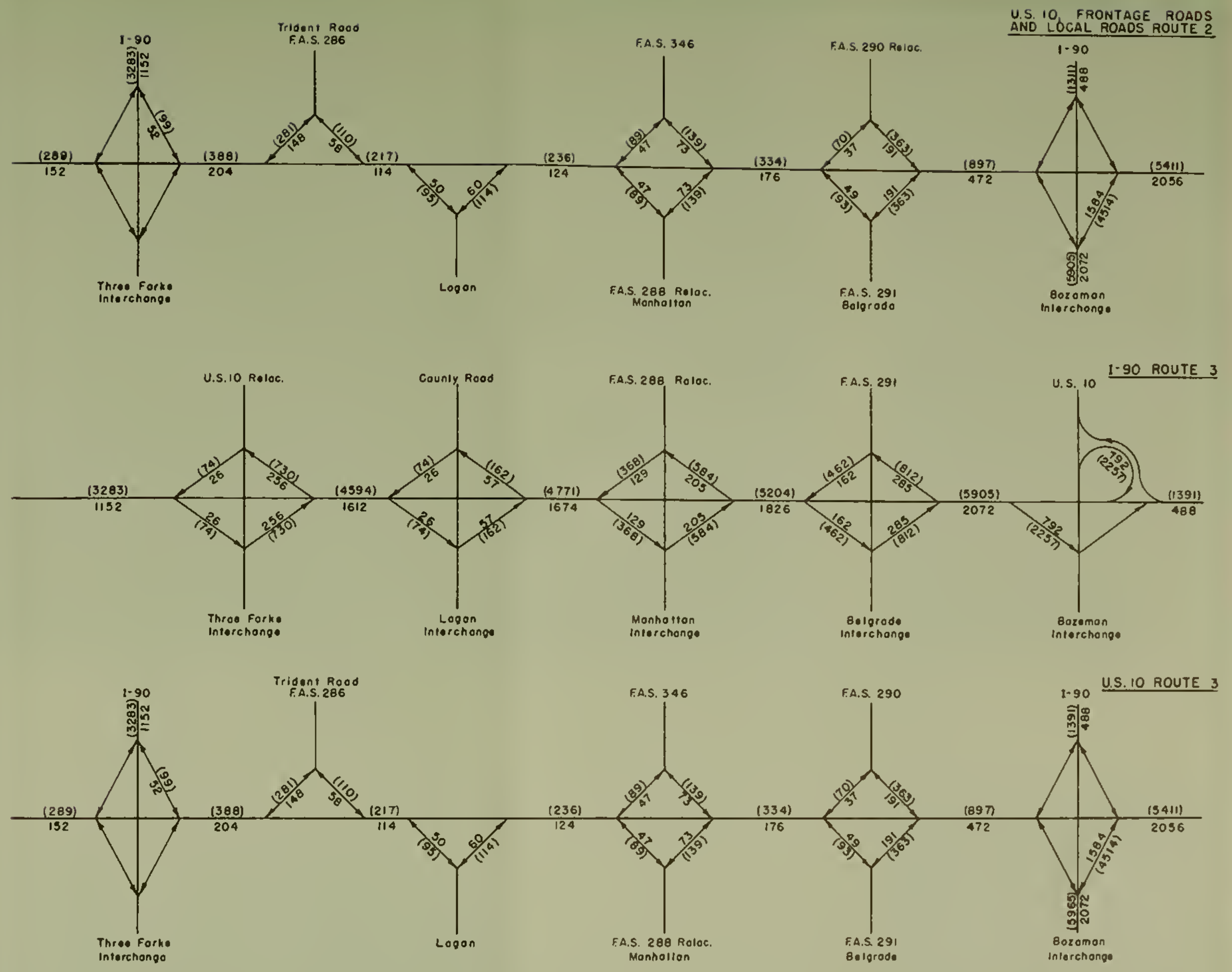
BRIDGE
TYPICAL SECTIONS

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

EXHIBIT 5


BROADWATER COUNTY
GALLATIN COUNTY
GALLATIN NATIONAL FOREST
ROUTE 1
ROUTE 2
ROUTE 3
ROUTE 3A
ROUTE 3N
ALTERNATE ROUTE SOUTH
THREE FORKS
BOZEMAN
LEGEND
22 Indicates Exhibit Number
Recommended Route
Alternate Route
Interchange
SCALE 0 2 MILES
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA
KEY MAP
TO PLAN & PROFILE SHEETS
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago





Notes:

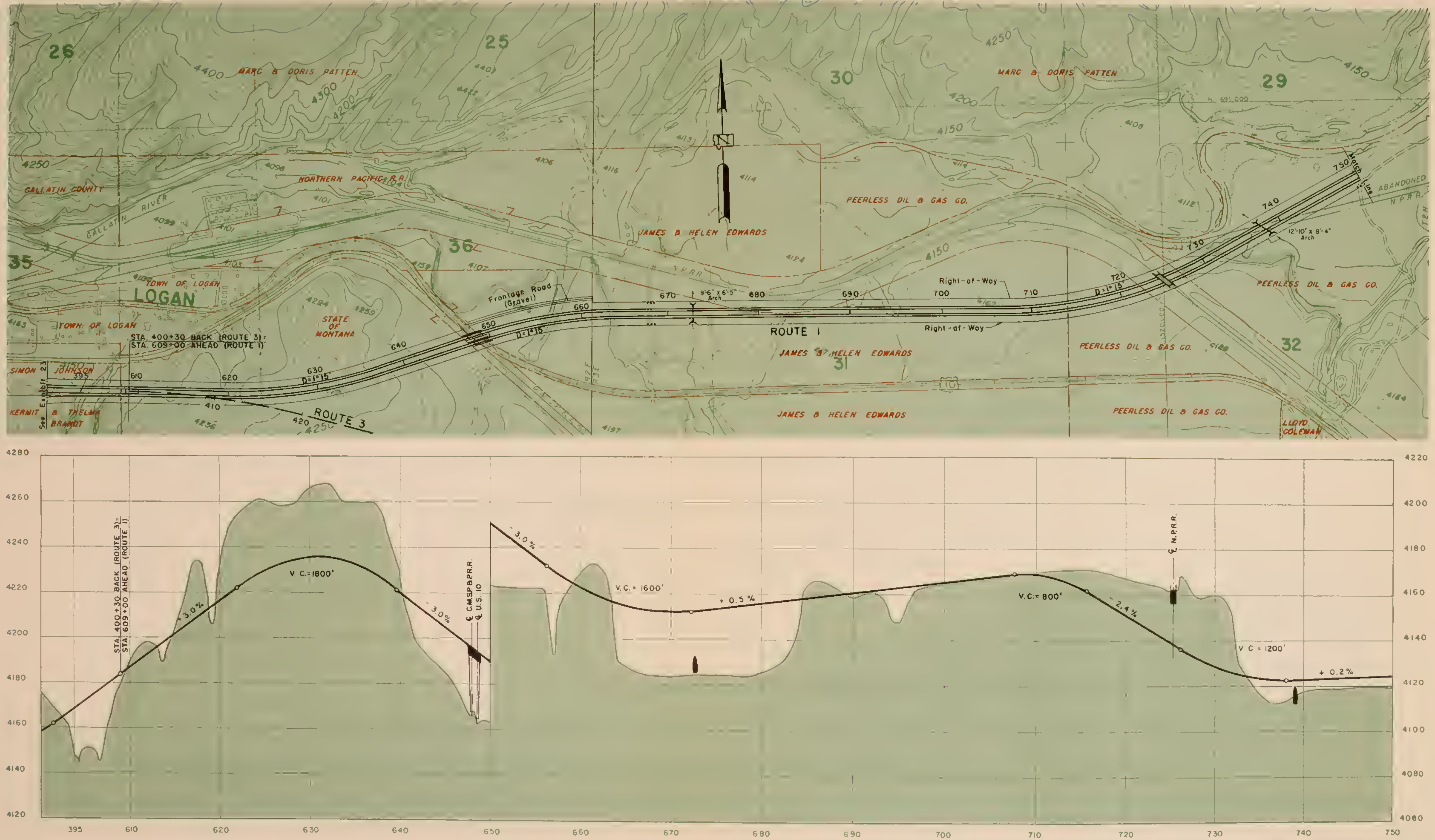
1. 1816 indicates 1958 ADT
2. (4486) indicates 1975 ADT
3. Expansion Factors
   a. Basic Condition (Existing U.S. 10)
      E.F. (1958-1975) = G (1+ S L I)
      = 1.30 (1+.60 x 1.30 x 1.15)
      = 2.47
   b. Interstate Route 90
      E.F. (1958-1975) = G (1+SLI)
      = 1.50 (1+.60 x 1.30 x 1.15)
      = 2.85
   c. Traffic Remaining on Existing U.S. 10
      (or Frontage Roads and Local Roads Route 2)
      E.F. (1958-1975) = G (1+SLI)
      = 1.00 (1+.60 x 1.30 x 1.15)
      = 1.90
4. DHV = 30 HV = 15% (1975 ADT)
5. Truck Traffic = 15% ADT
   One Truck = 3.5 Passenger Vehicles
   Equivalent Passenger Vehicle = 1.375 ADT

INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

TRAFFIC DIAGRAMS

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

EXHIBIT 7



SCALE

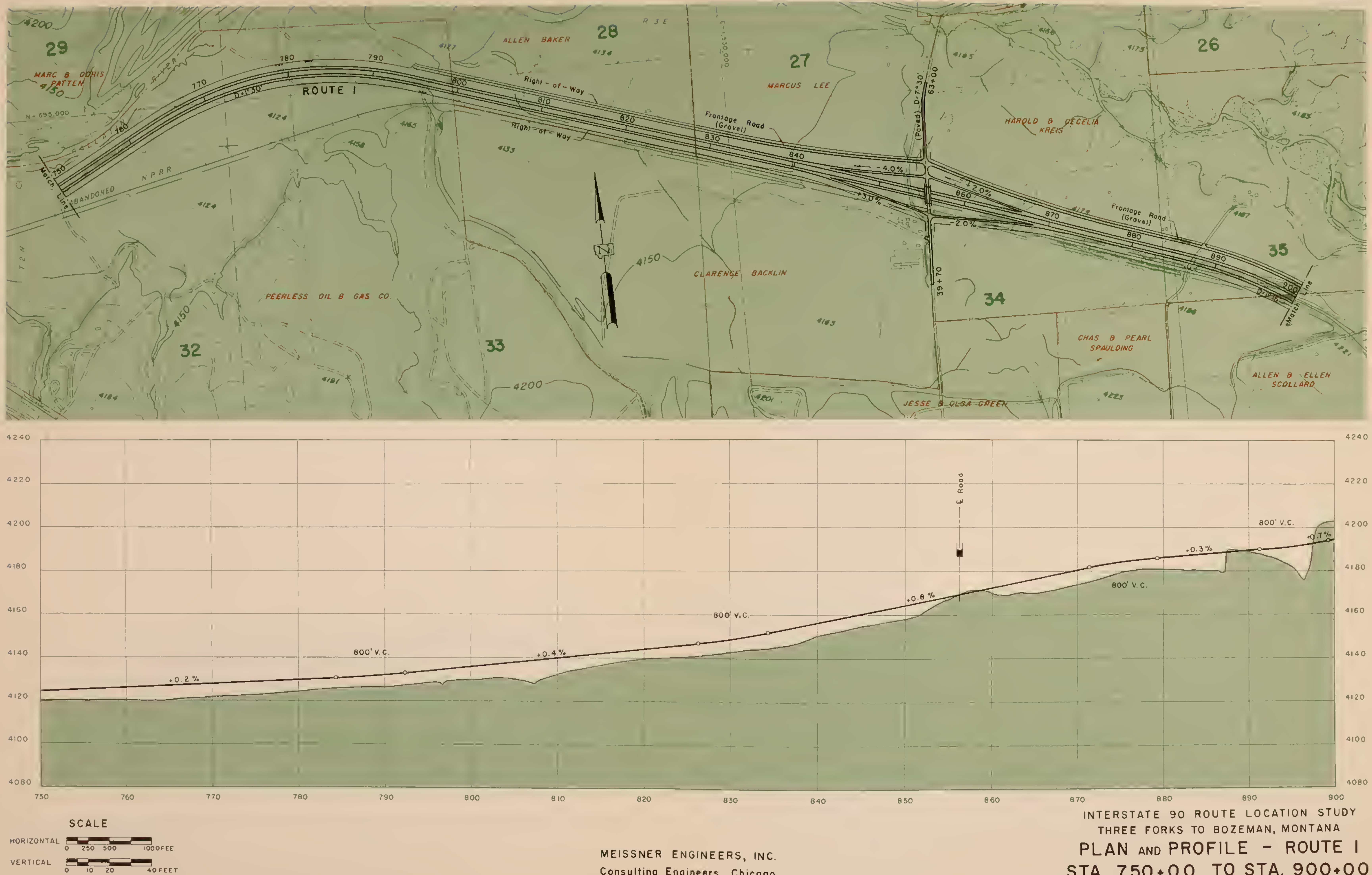
HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 1
STA. 609+00 TO STA. 750+00



INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE – ROUTE I
STA. 750+00 TO STA. 900+00

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

EXHIBIT 9

SCALE

HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 1
STA. 900+00 TO STA. 1080+00

EXHIBIT 10

SCALE

HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE I
STA. 1080+00 TO STA. 1260+00

EXHIBIT 11

SCALE

HORIZONTAL 0 250 500 1000 FEET

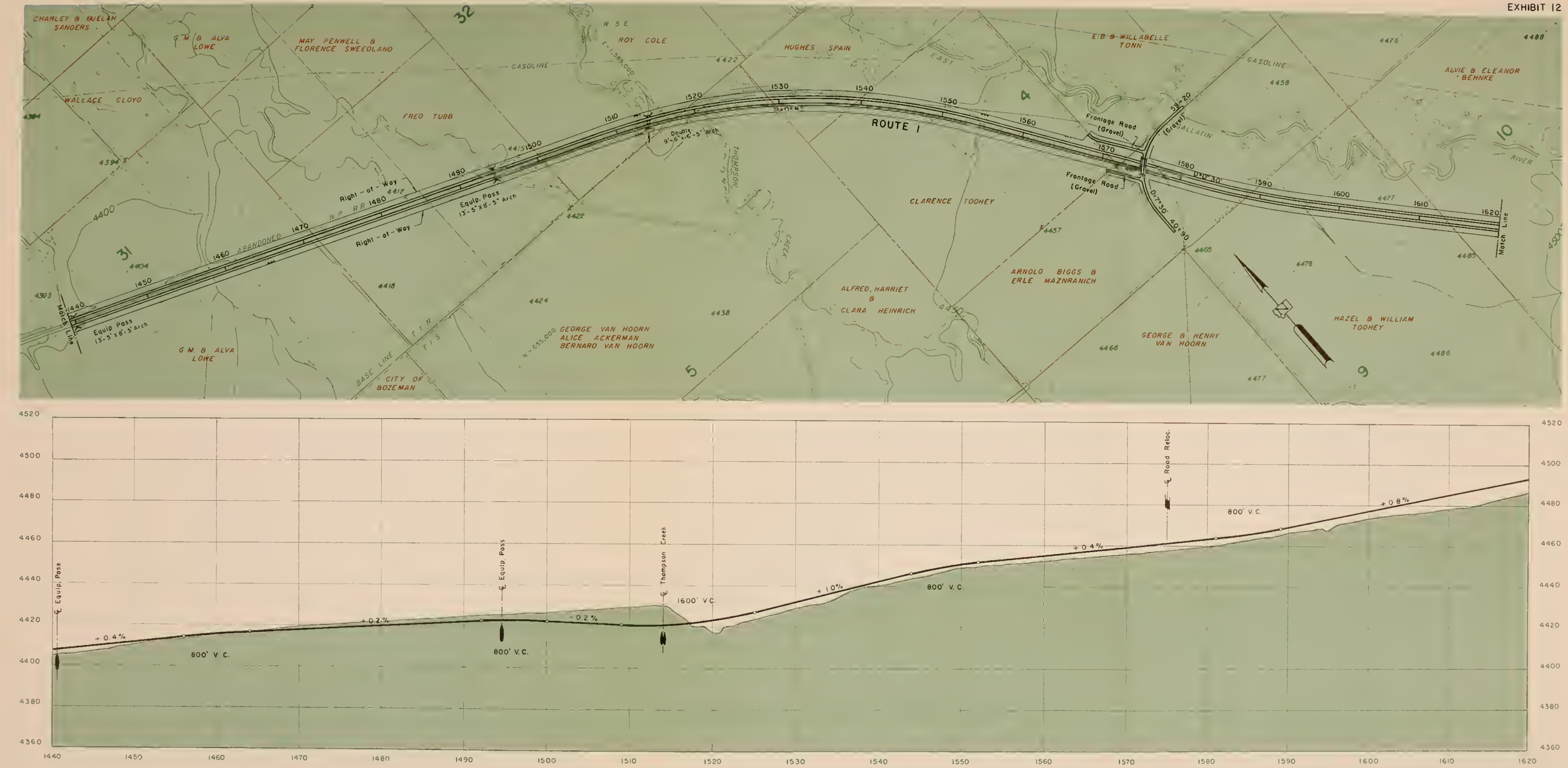
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 1
STA. 1260+00 TO STA. 1440+00

EXHIBIT 12



SCALE

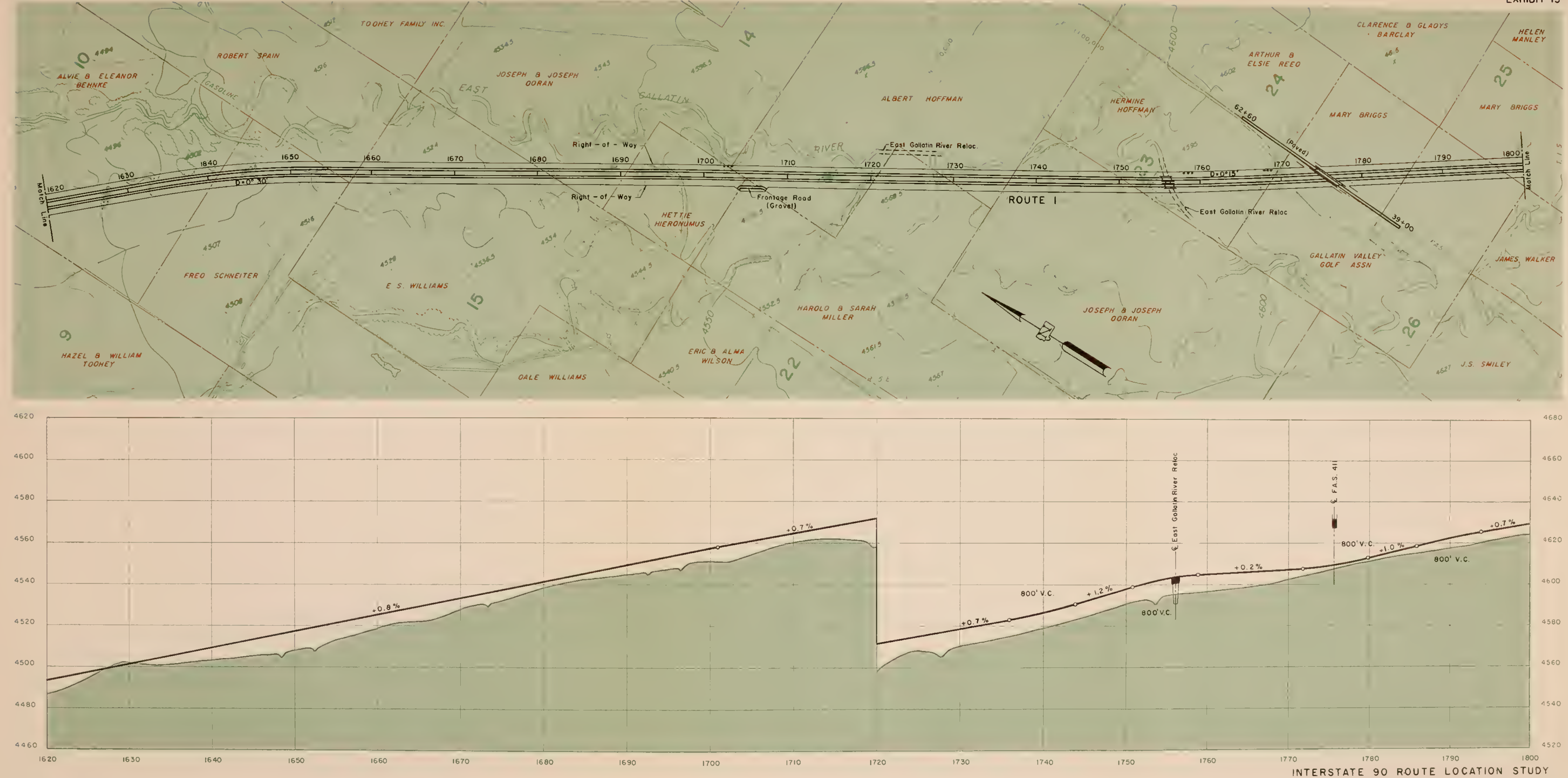
HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE I
STA. 1440+00 TO STA. 1620+00



SCALE

HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

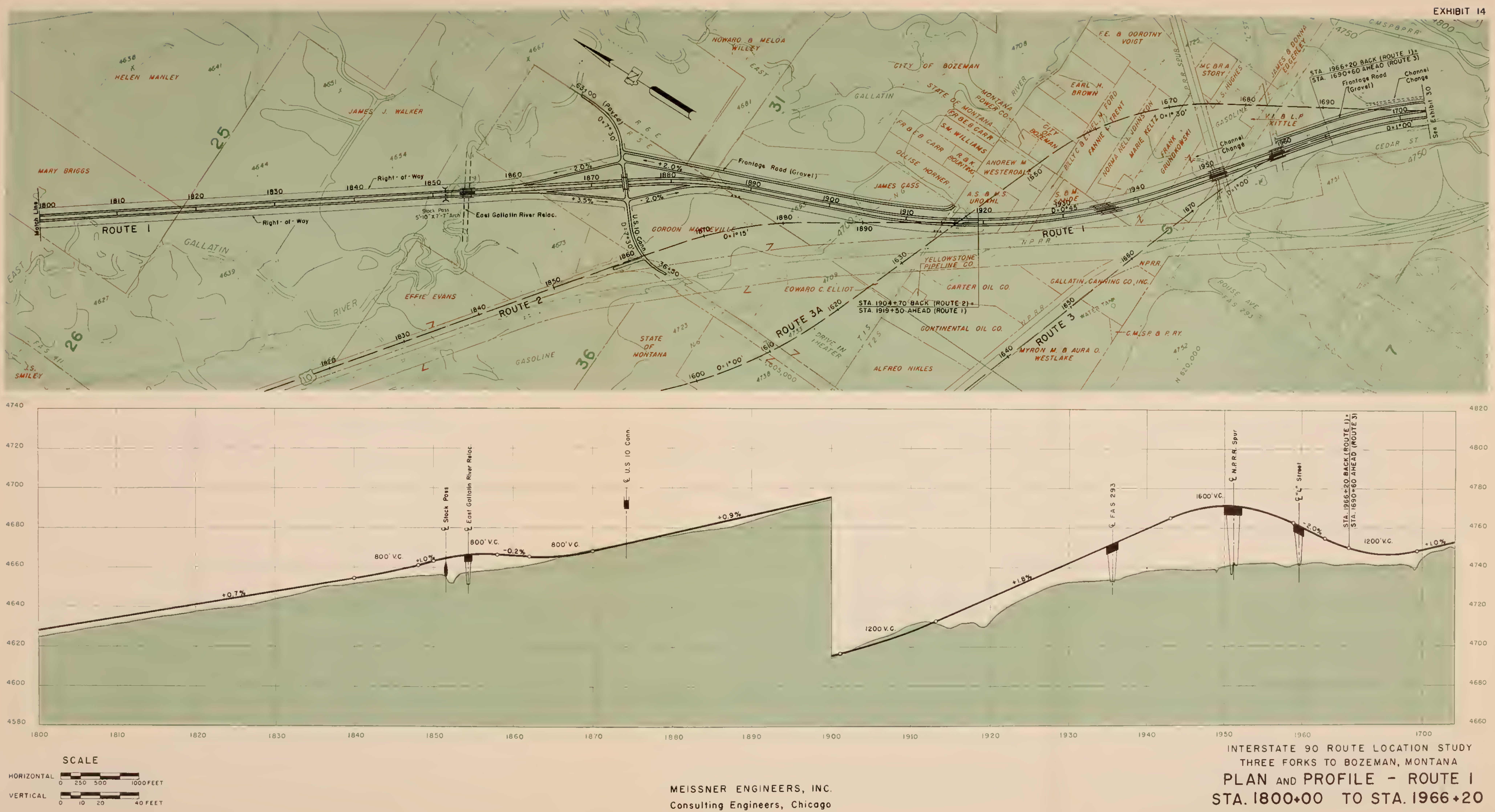
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE I

STA. 1620+00 TO STA. 1800+00

EXHIBIT 14

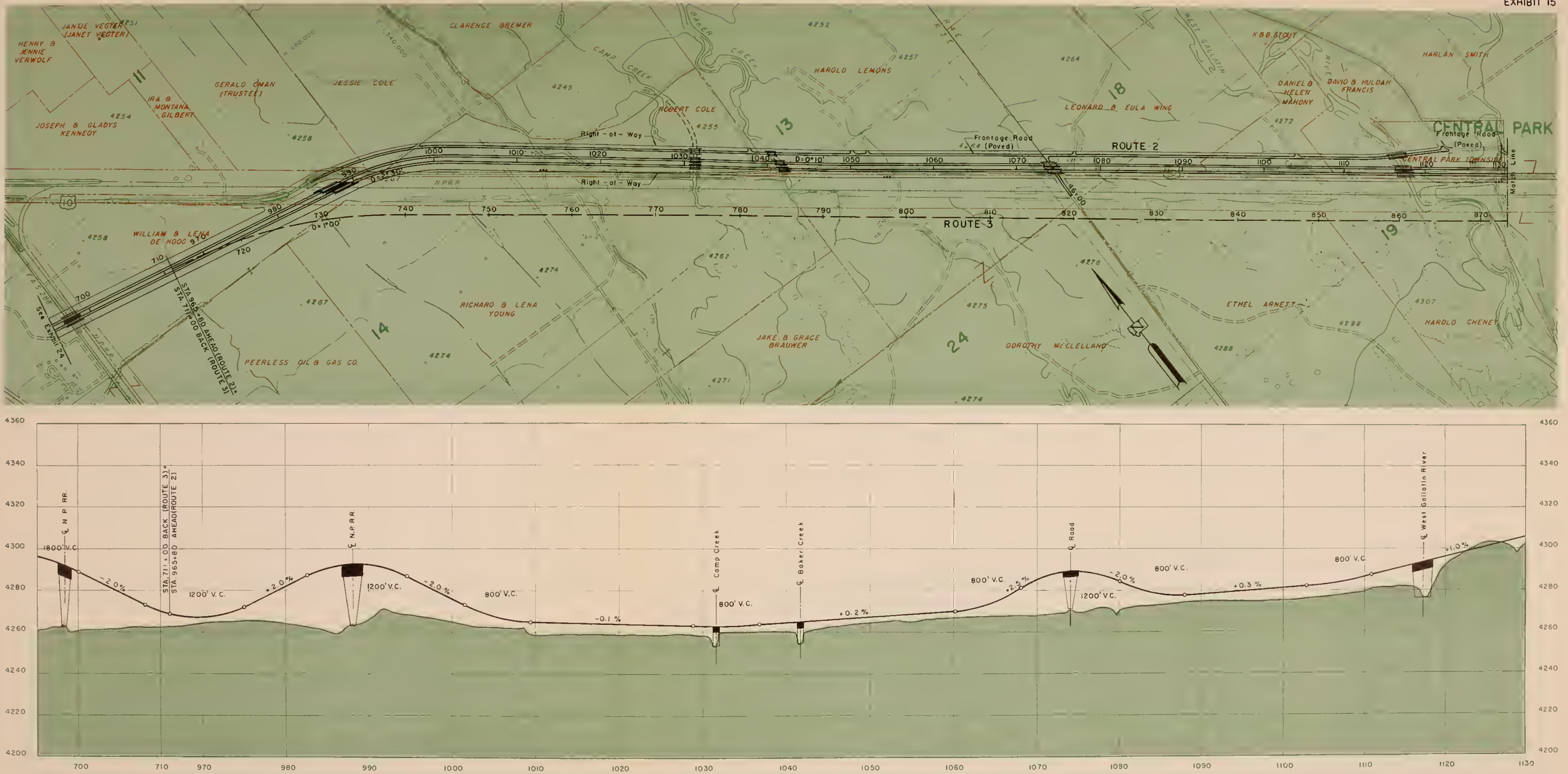


MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 1
STA. 1800+00 TO STA. 1966+20

EXHIBIT 15



SCALE

HORIZONTAL 0 250 500 1000 FEET

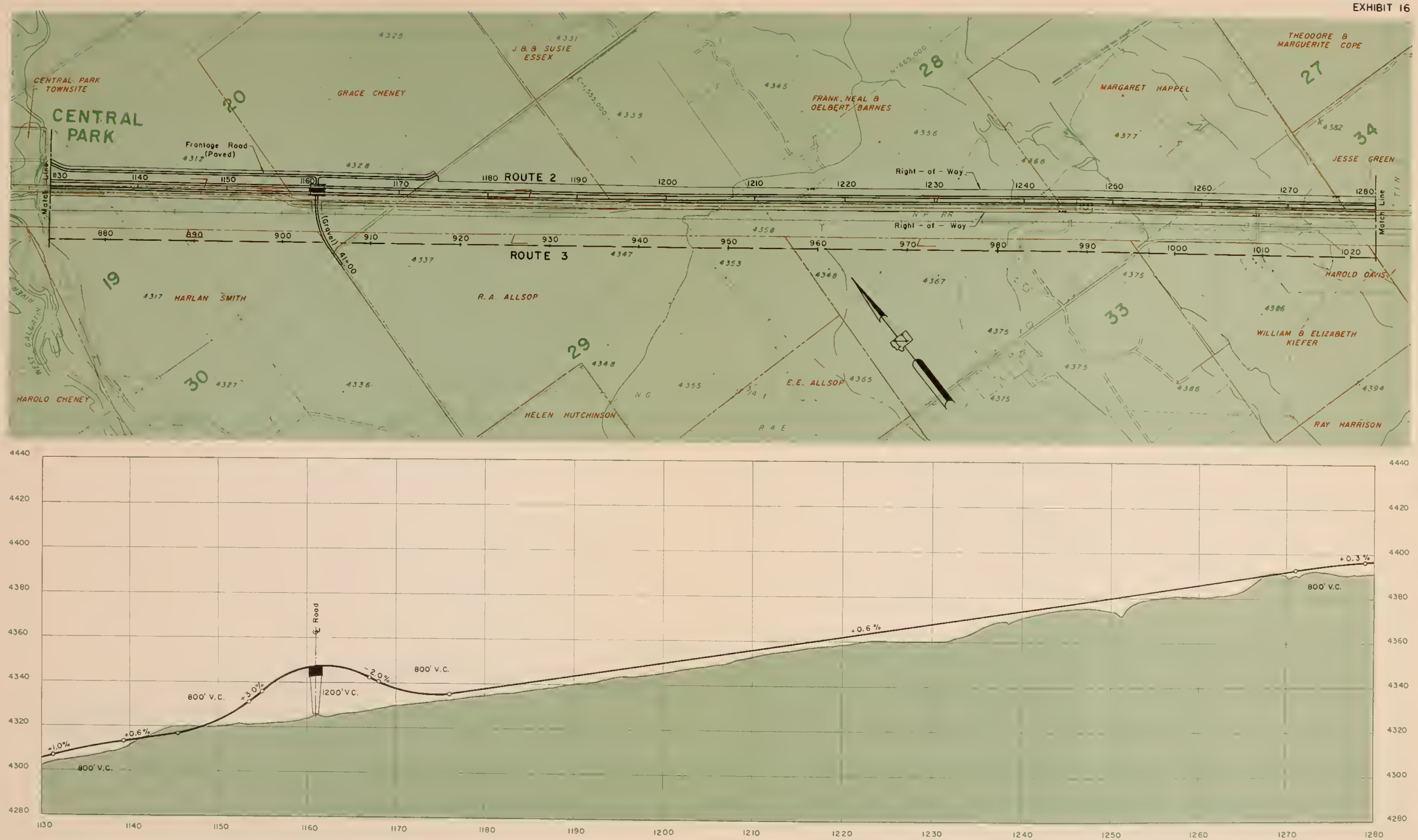
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 2
STA. 965+80 TO STA. 1130+00

EXHIBIT 16



SCALE

HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

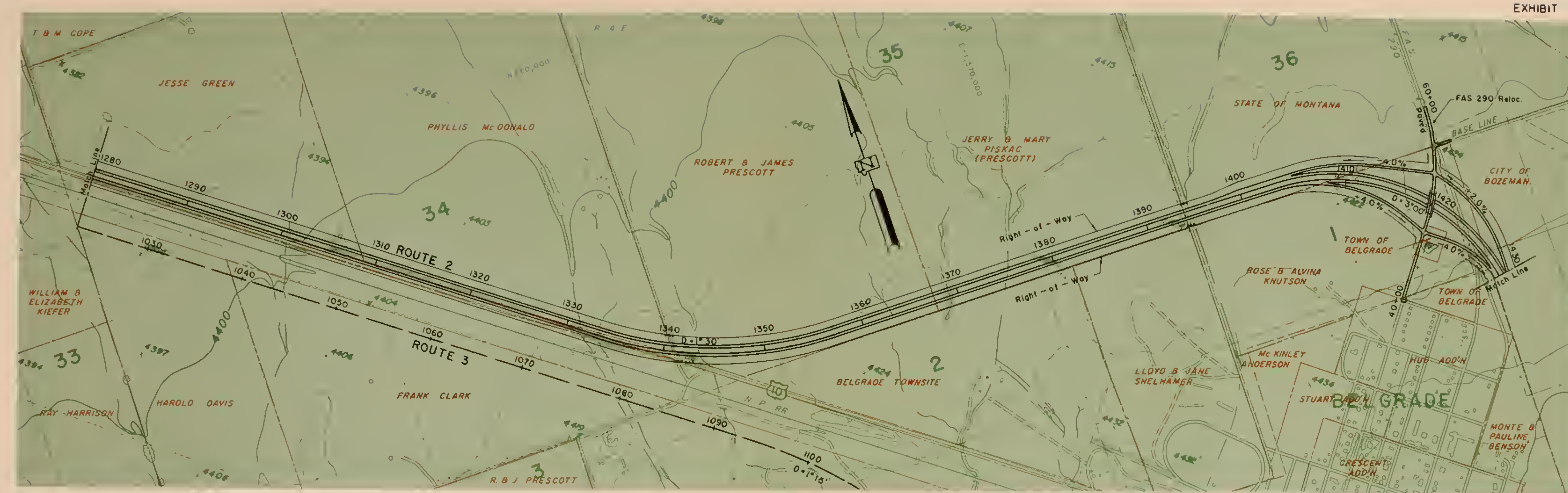
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

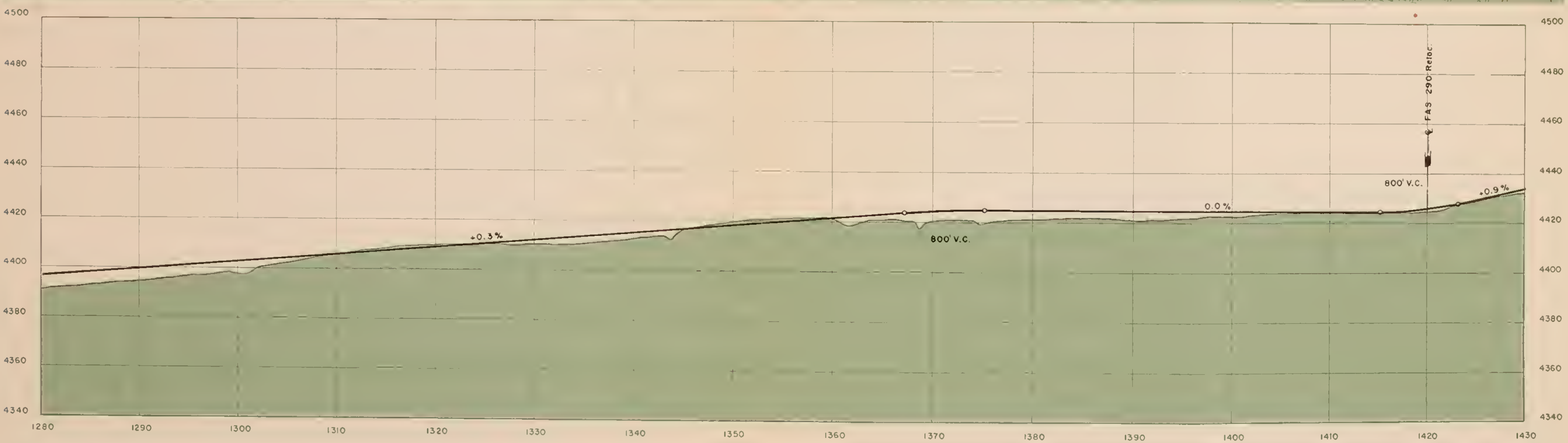
INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 2

STA. 1130+00 TO STA. 1280+00

EXHIBIT 17



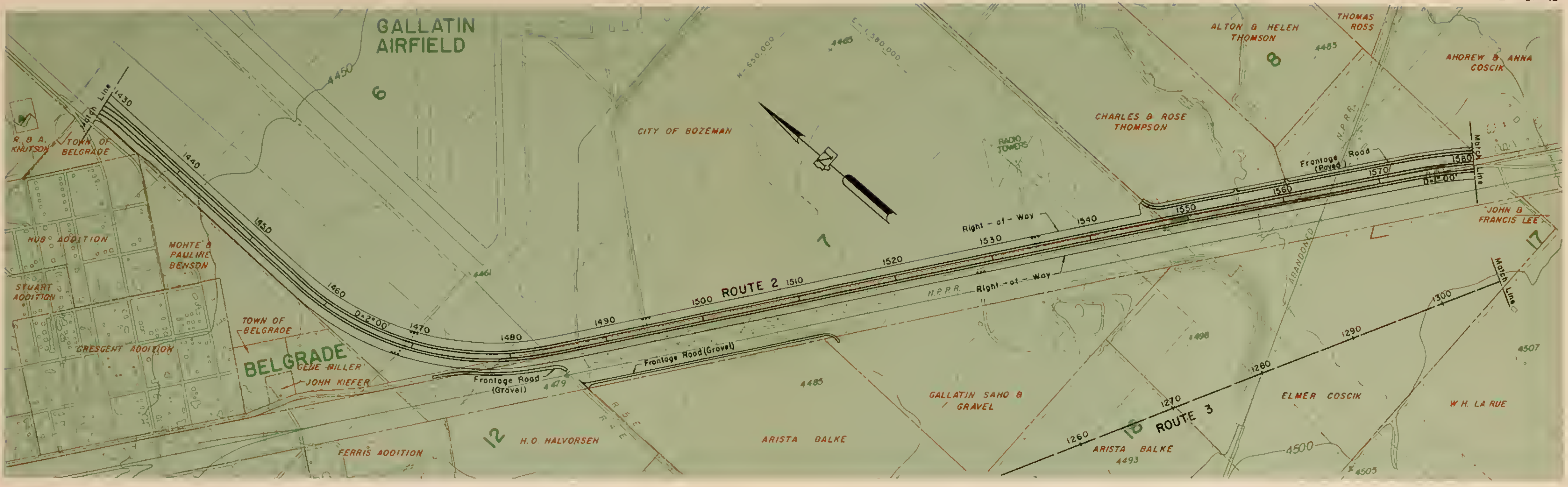


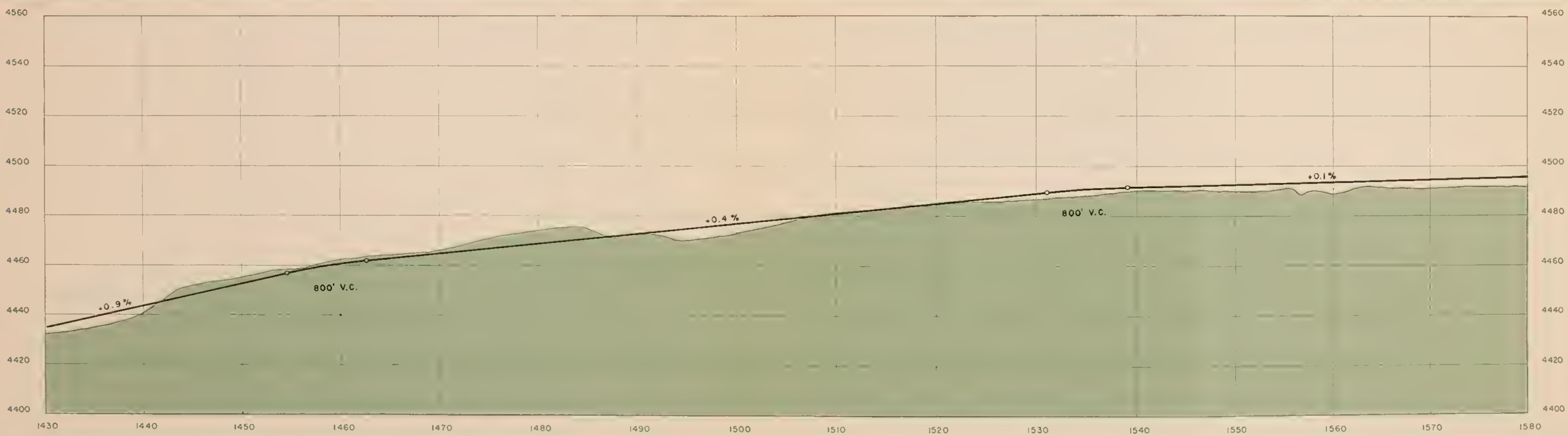
SCALE
HORIZONTAL 0 250 500 1000 FEET
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 2
STA. 1280+00 TO STA. 1430+00





SCALE

HORIZONTAL 0 250 500 1000 FEET

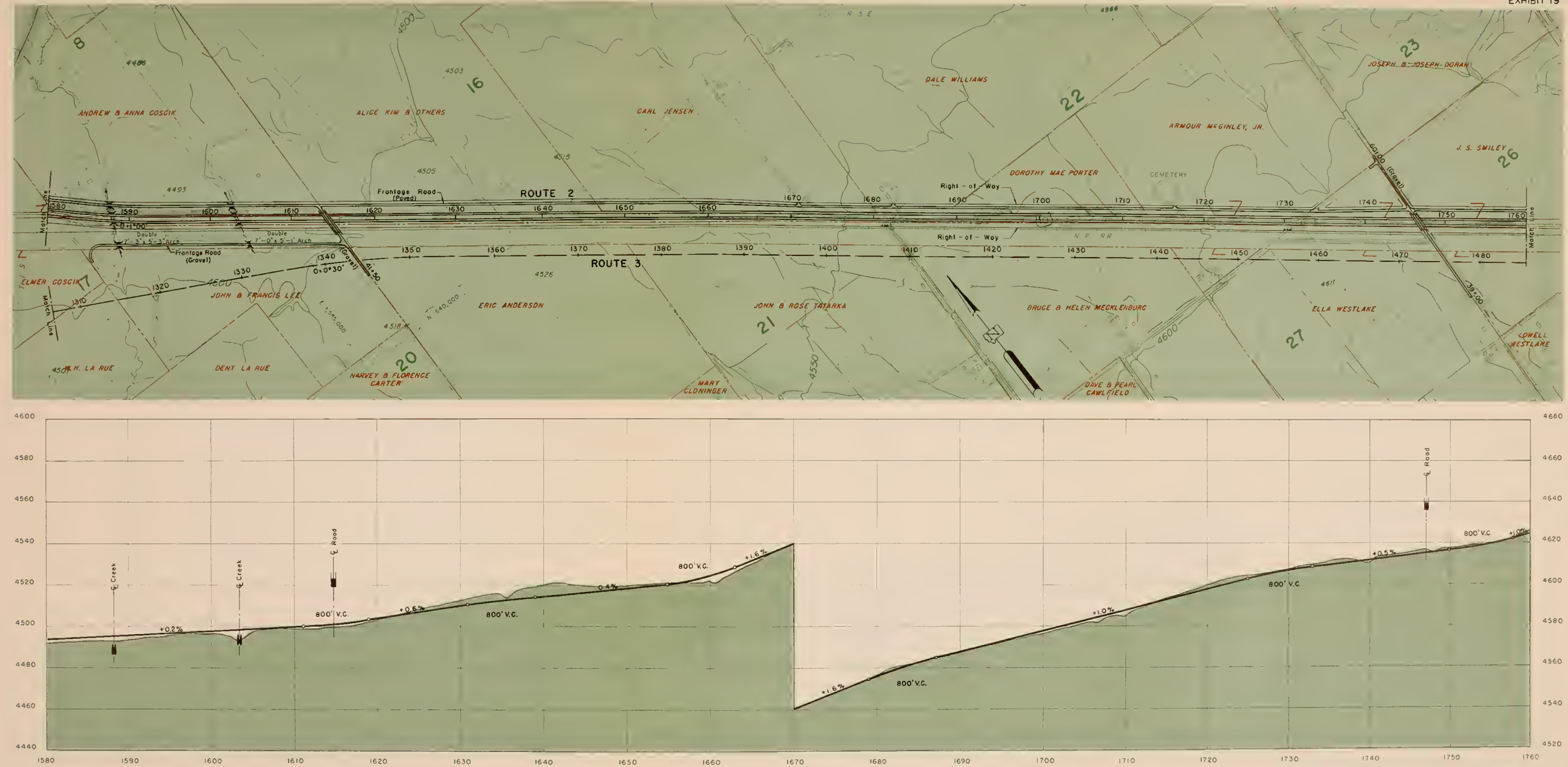
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 2
STA. 1430+00 TO STA. 1580+00

EXHIBIT 19



SCALE

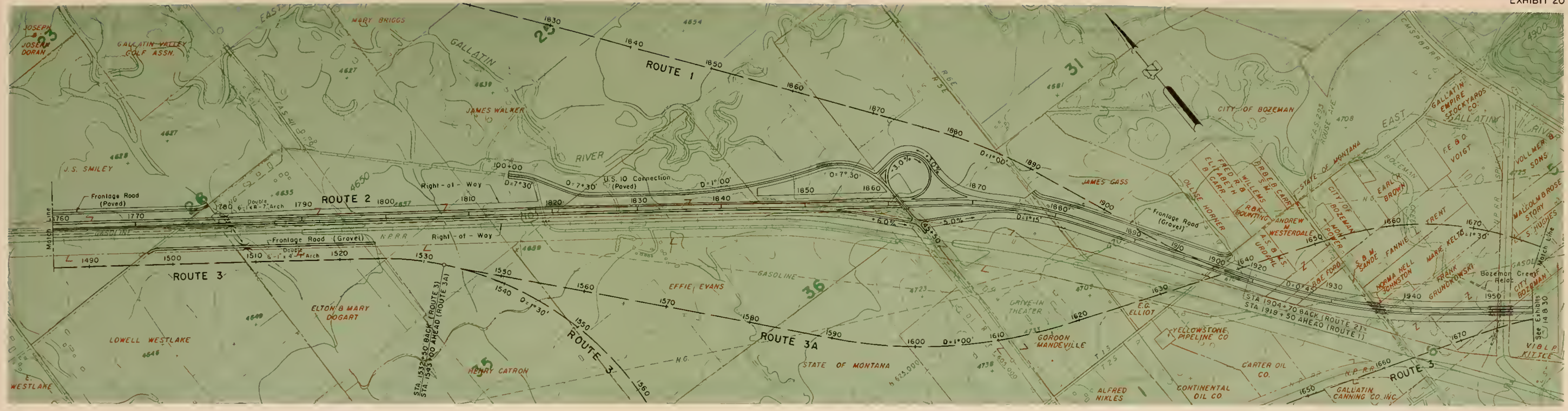
HORIZONTAL 0 250 500 1000 FEET

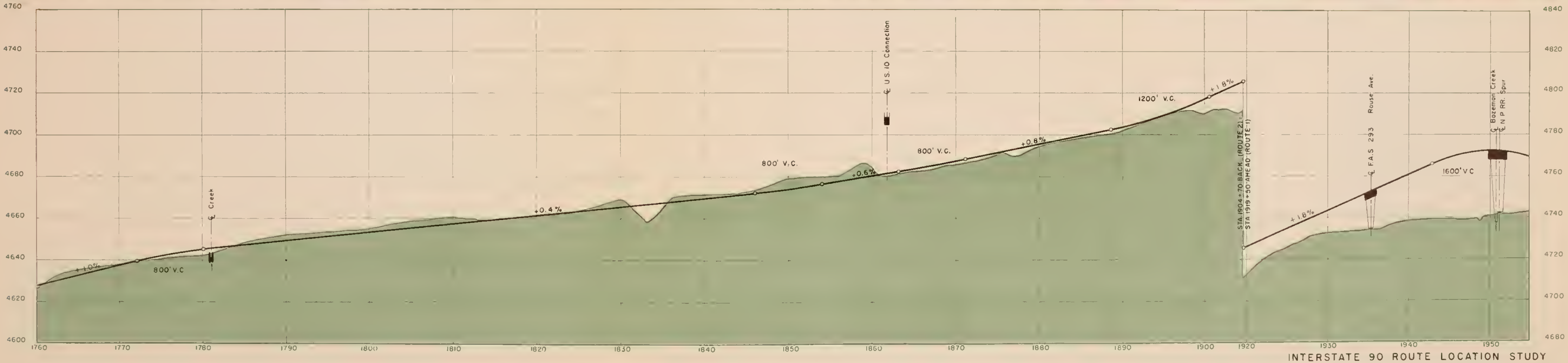
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 2
STA. 1580+00 TO STA. 1760+00





SCALE

HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 2
STA. 1760+00 TO STA. 1904+70

SCALE

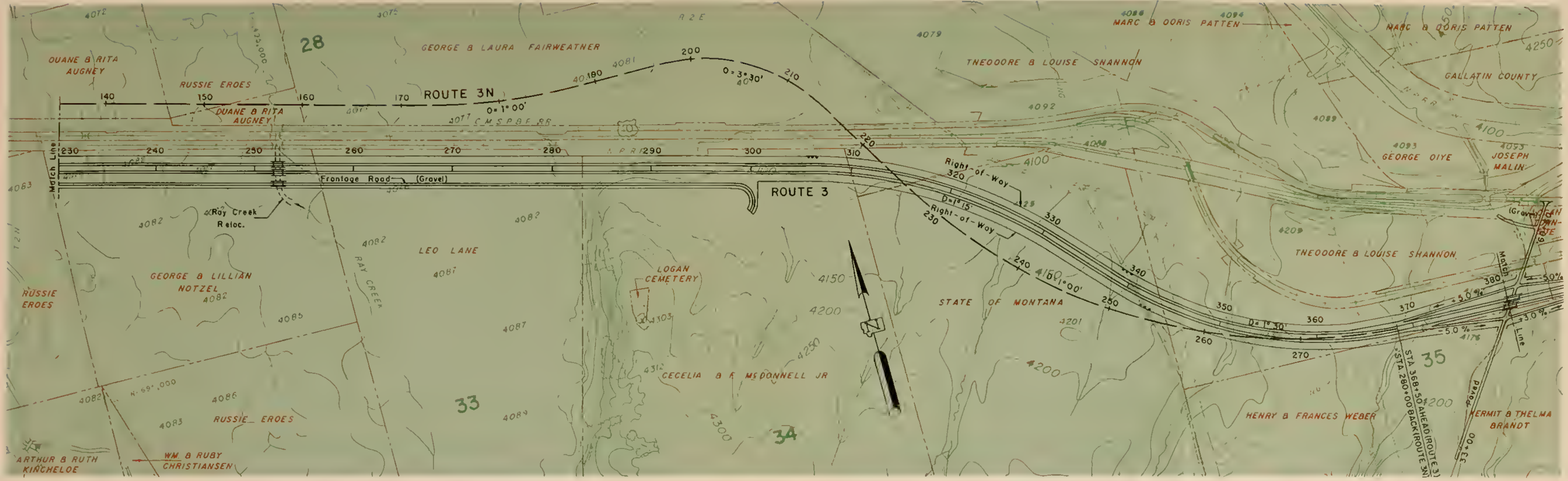
HORIZONTAL 0 250 500 1000 FEET

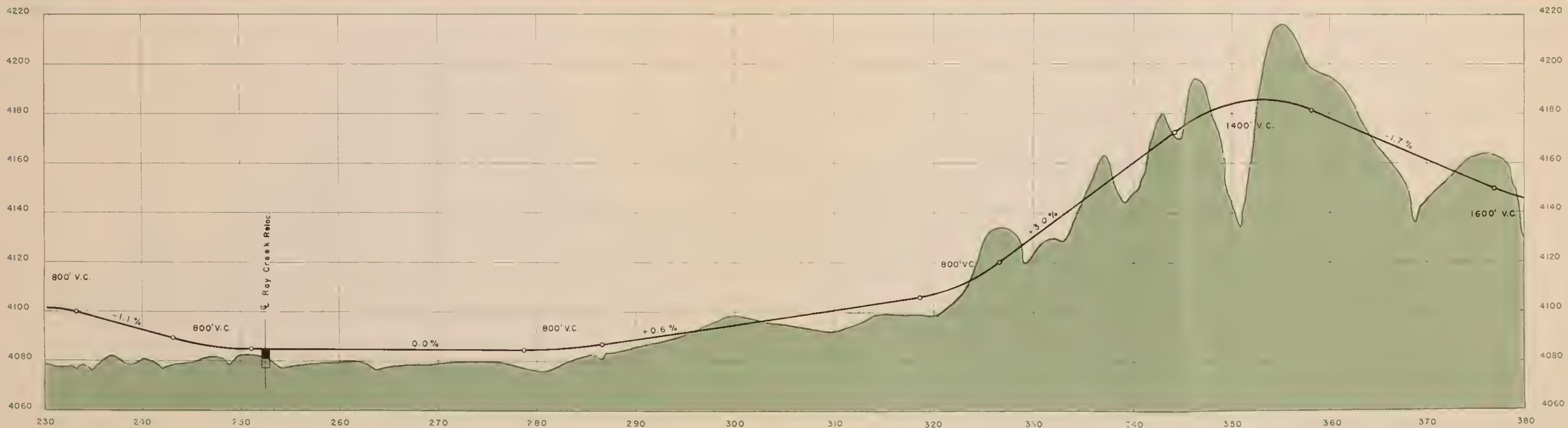
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 126+00 TO STA. 230+00





SCALE

HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 230+00 TO STA. 380+00

SCALE

HORIZONTAL 0 250 500 1000 FEET

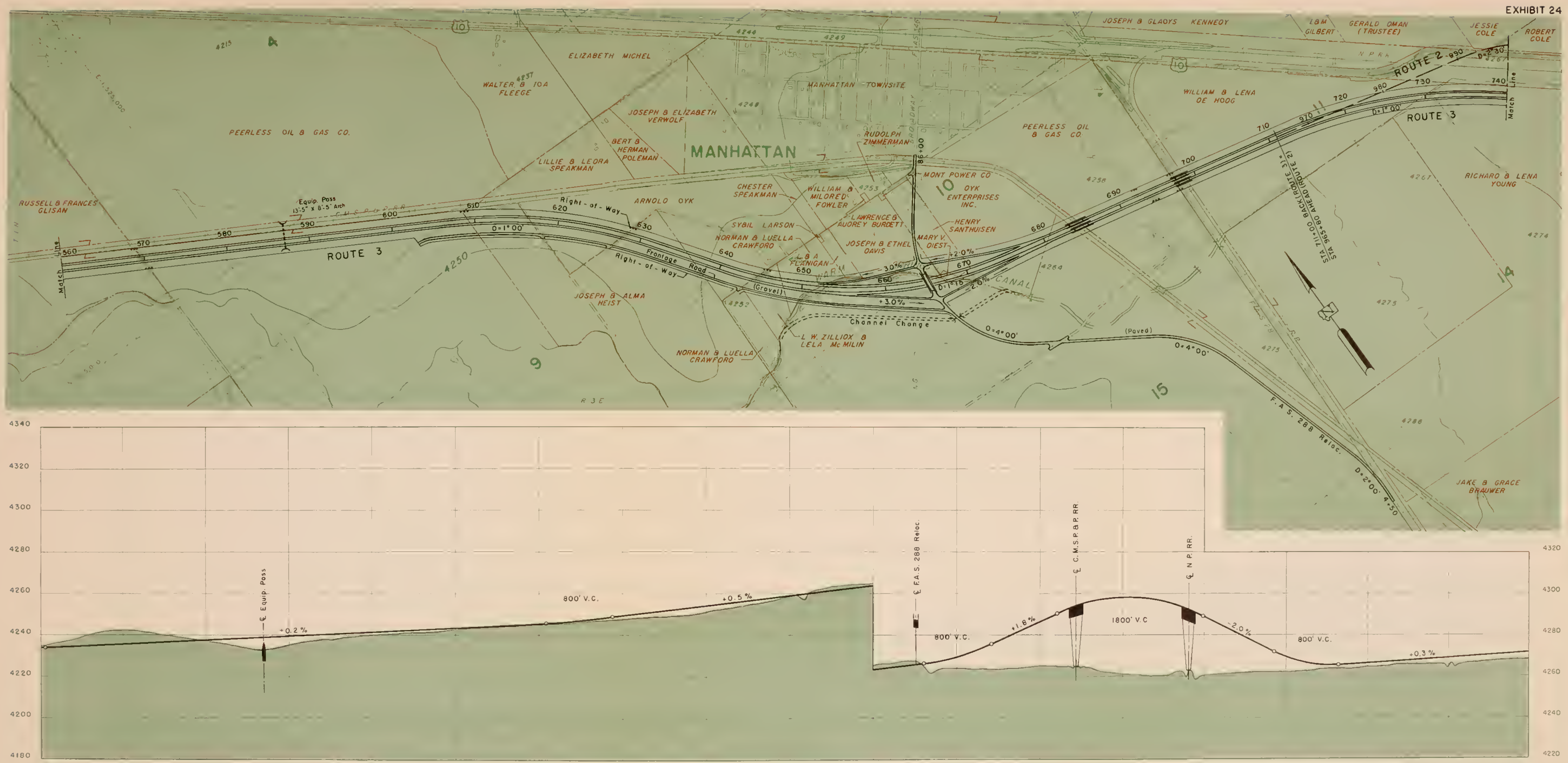
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 380+00 TO STA. 560+00

EXHIBIT 24



SCALE

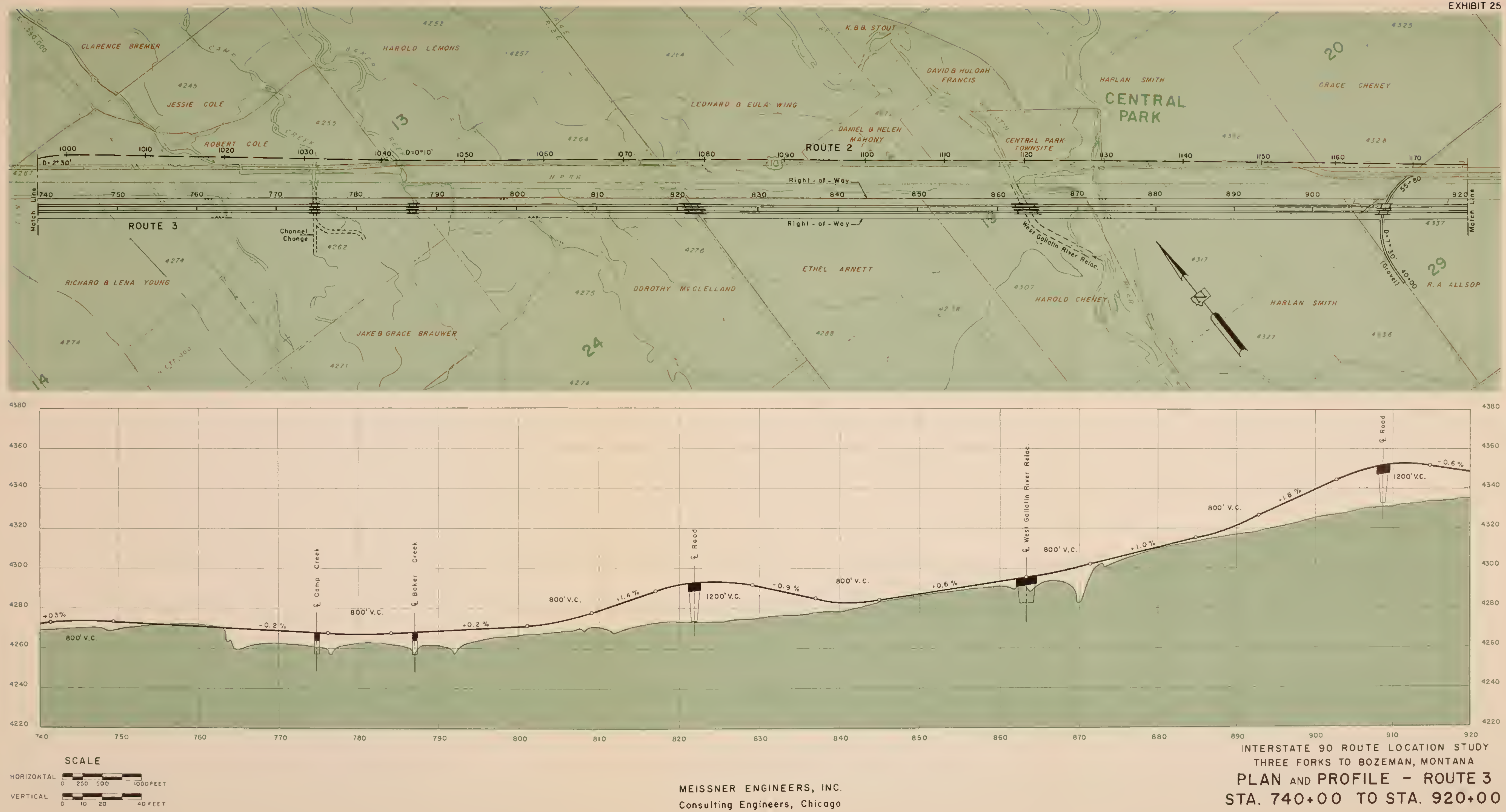
HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

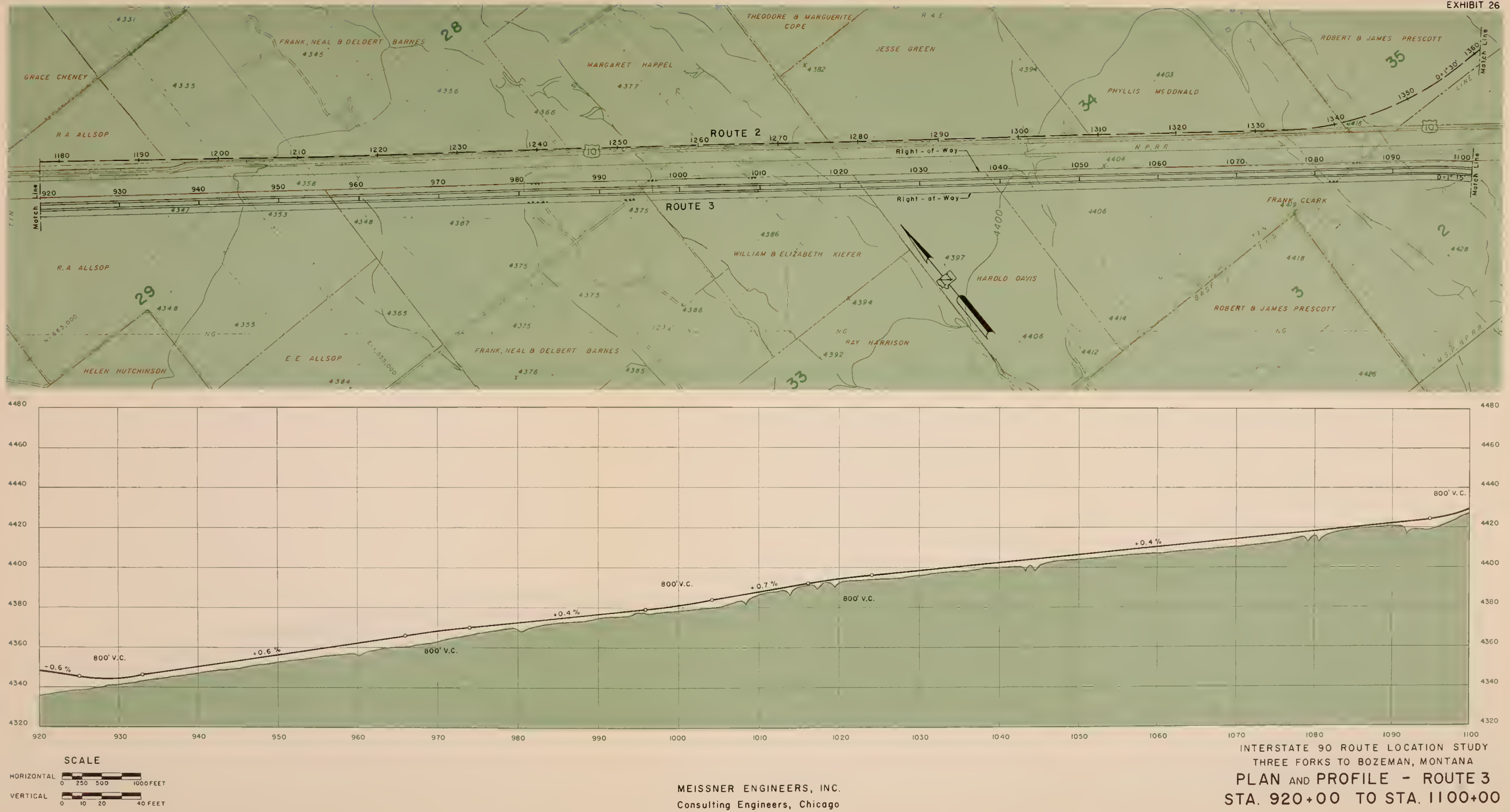
PLAN AND PROFILE - ROUTE 3
STA. 560+00 TO STA. 740+00



MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

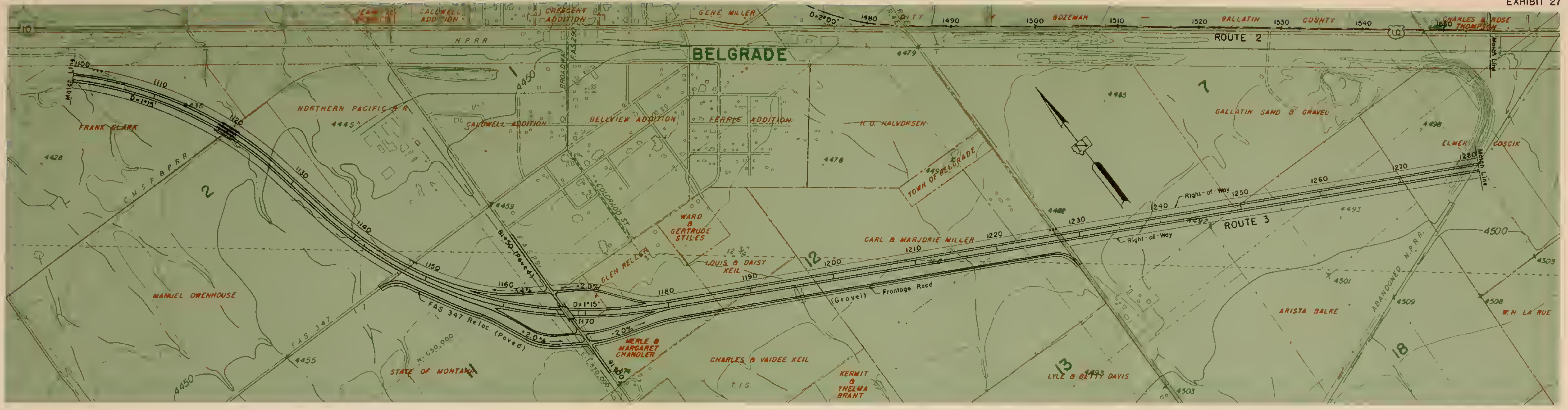
INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

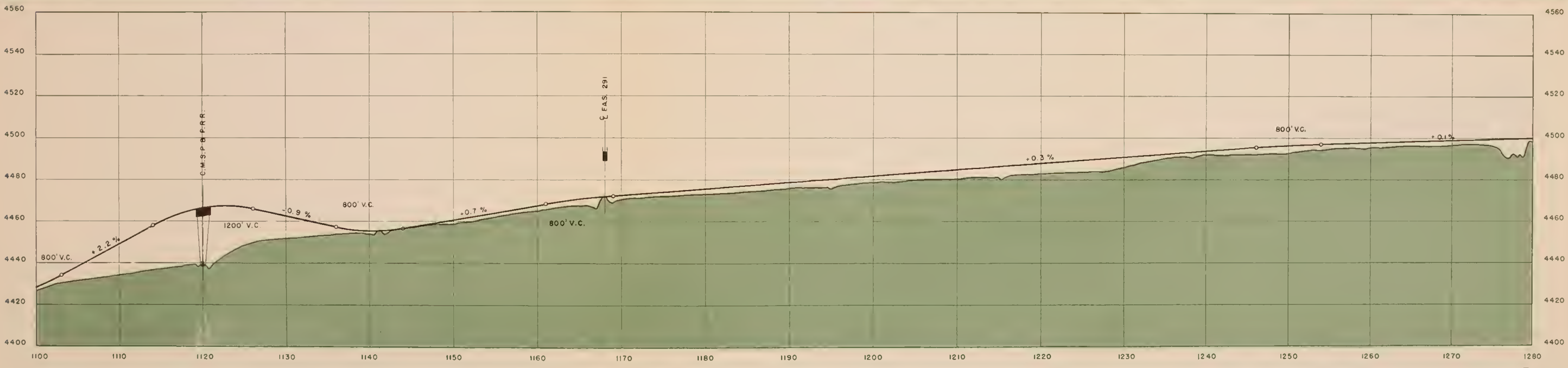
PLAN AND PROFILE - ROUTE 3
STA. 740+00 TO STA. 920+00



MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA
PLAN AND PROFILE - ROUTE 3
STA. 920+00 TO STA. 1100+00





SCALE

HORIZONTAL 0 250 500 1000 FEET

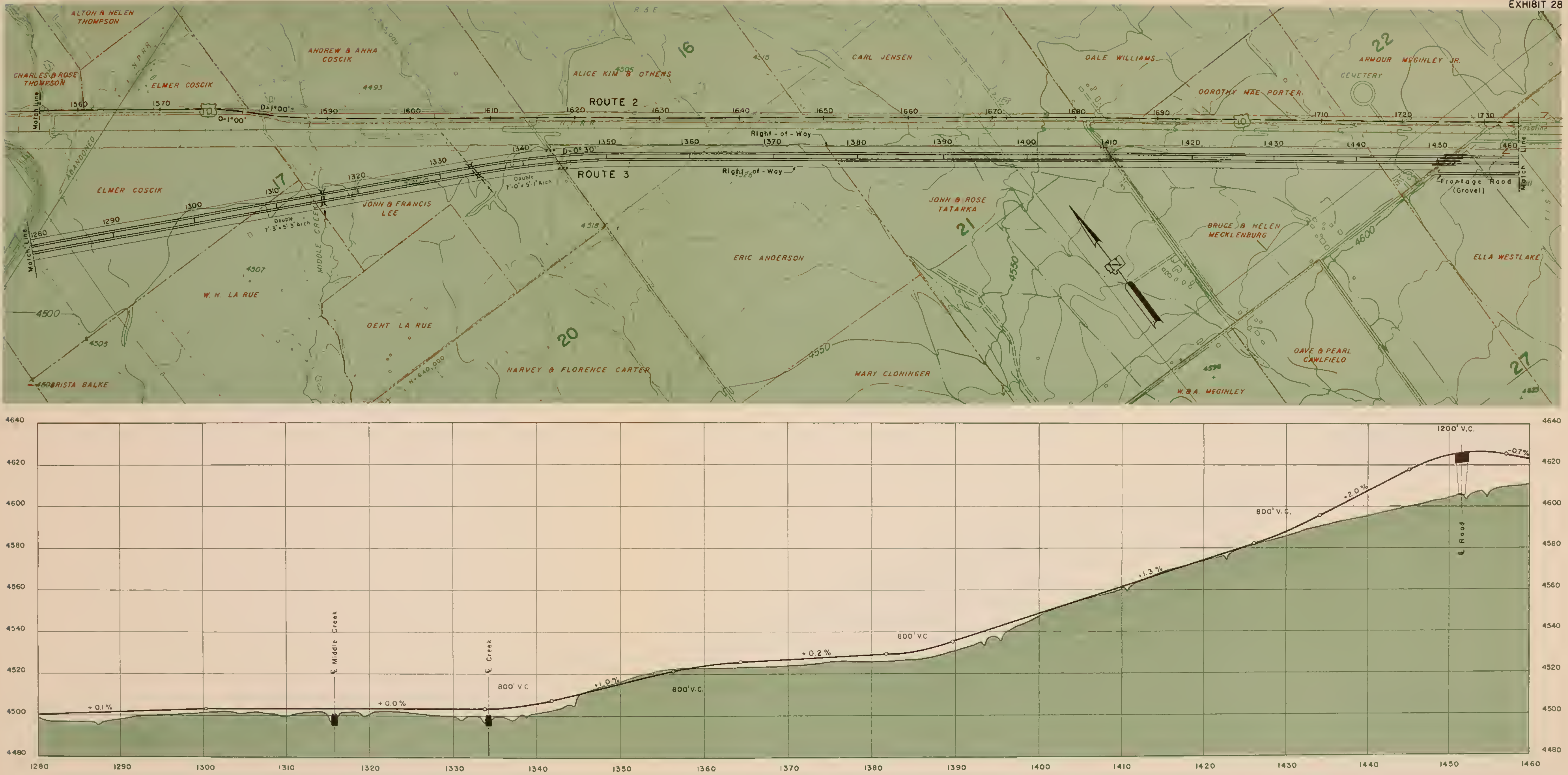
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 1100+00 TO STA. 1280+00

EXHIBIT 28



SCALE

HORIZONTAL 0 250 500 1000 FEET

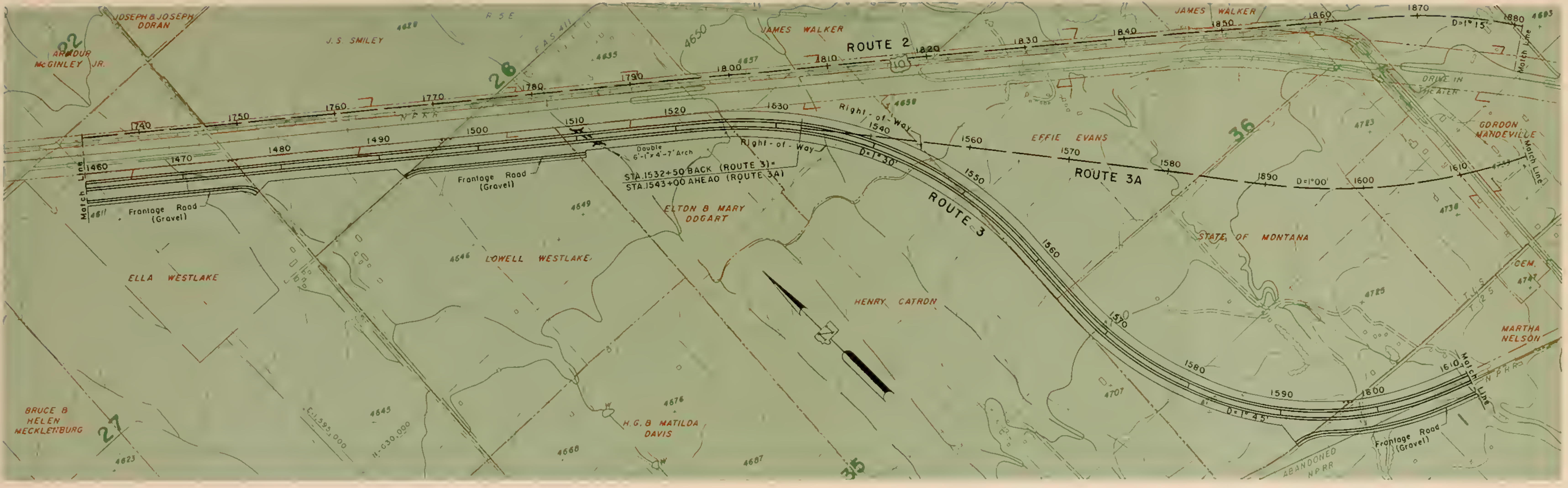
VERTICAL 0 10 20 40 FEET

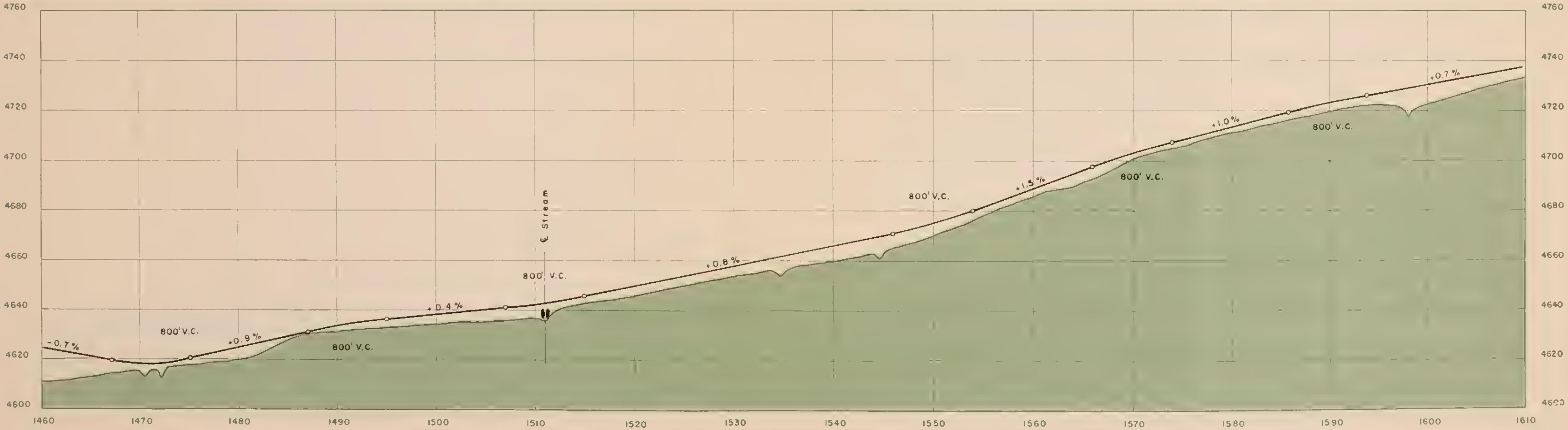
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 1280+00 TO STA. 1460+00

EXHIBIT 29





SCALE

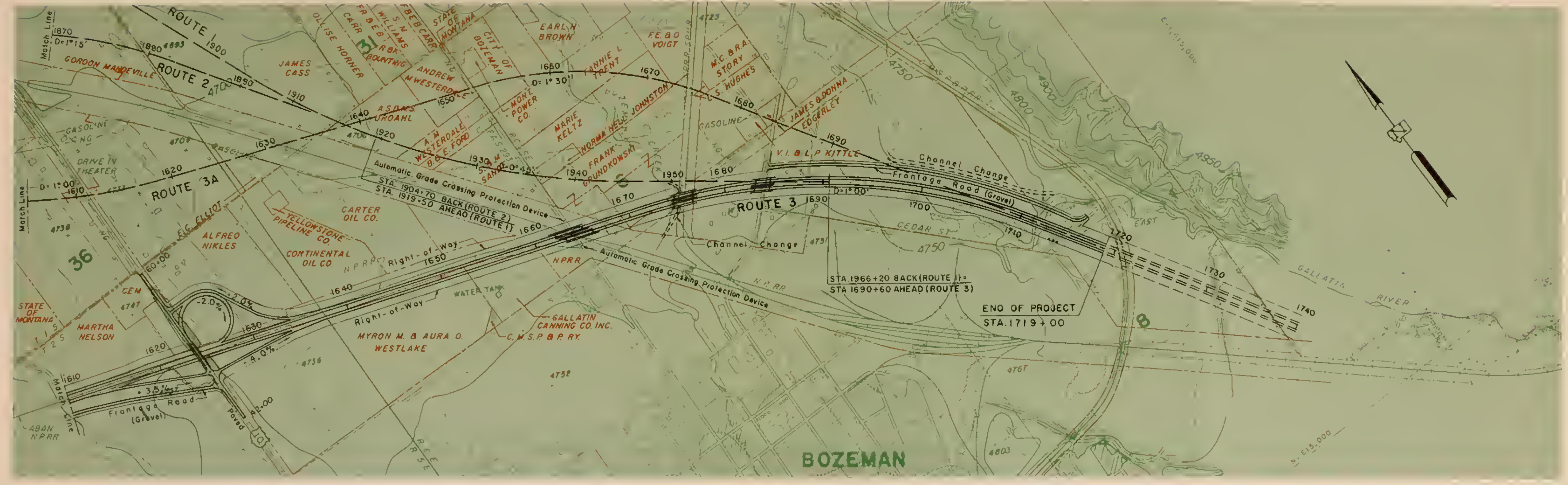
HORIZONTAL 0 250 500 1000 FEET

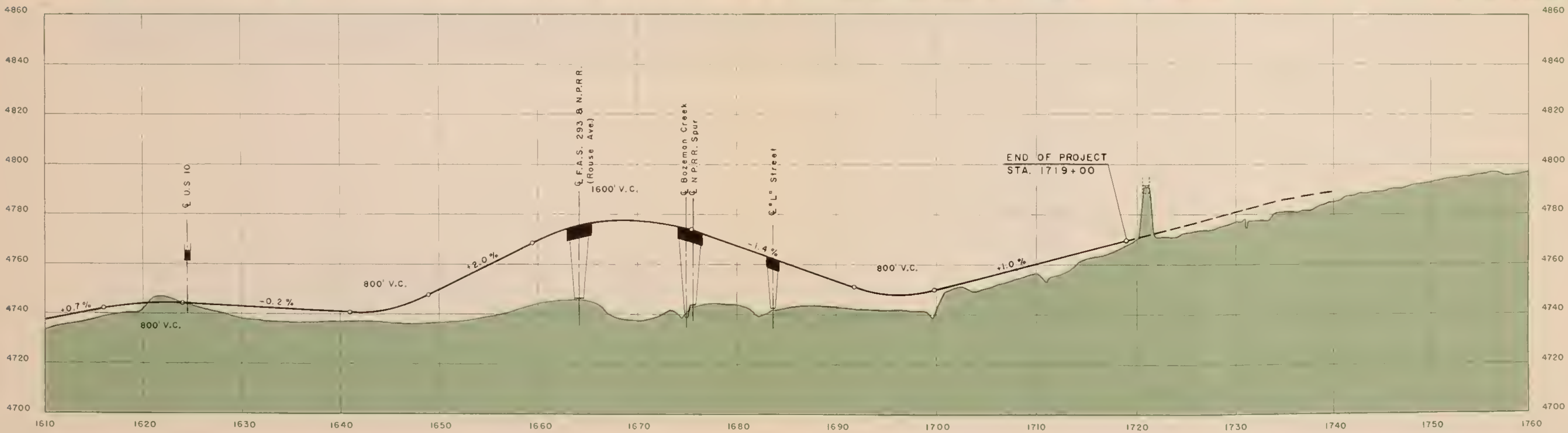
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 1460+00 TO STA. 1610+00





SCALE

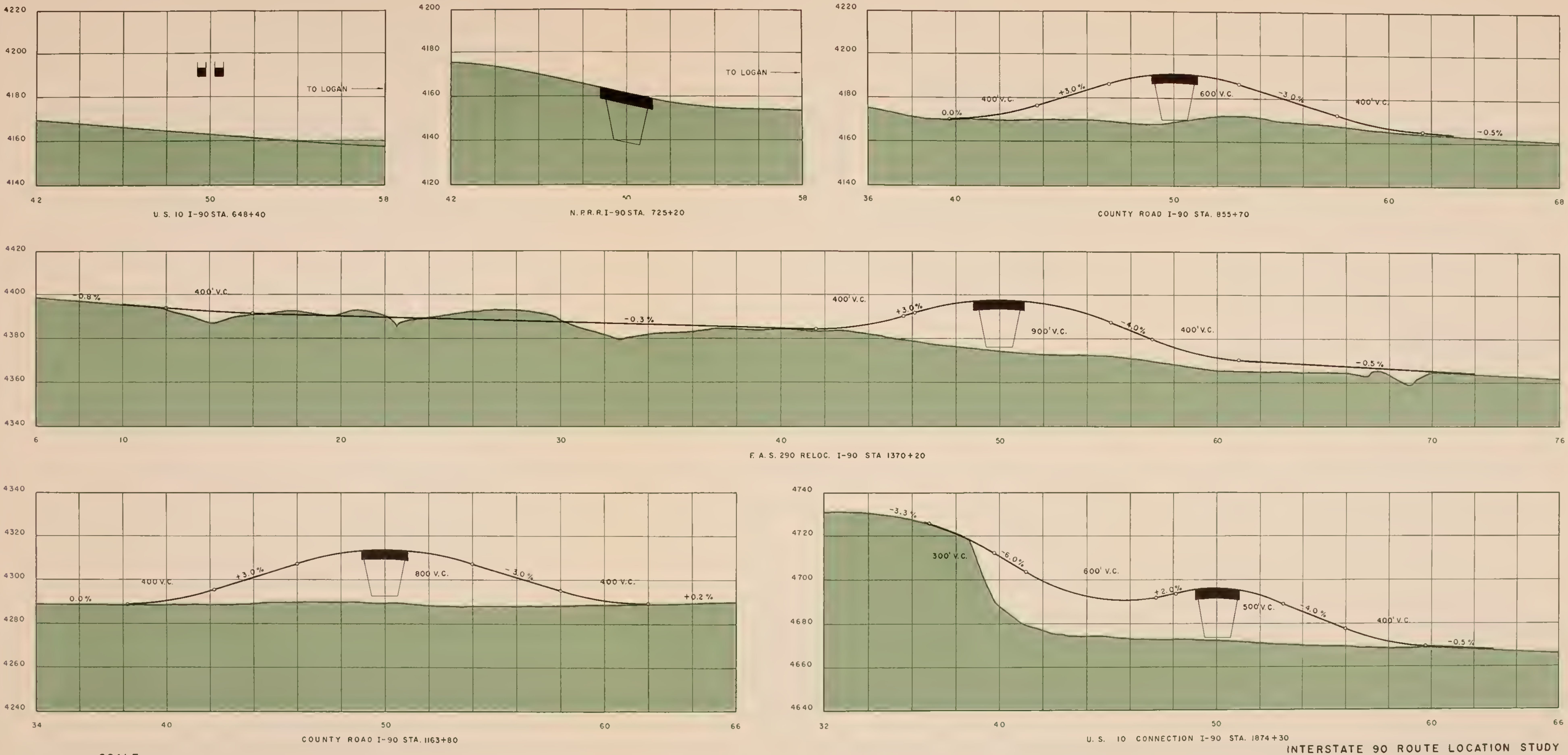
HORIZONTAL 0 250 500 1000 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

PLAN AND PROFILE - ROUTE 3
STA. 1610+00 TO STA. 1719+00



SCALE

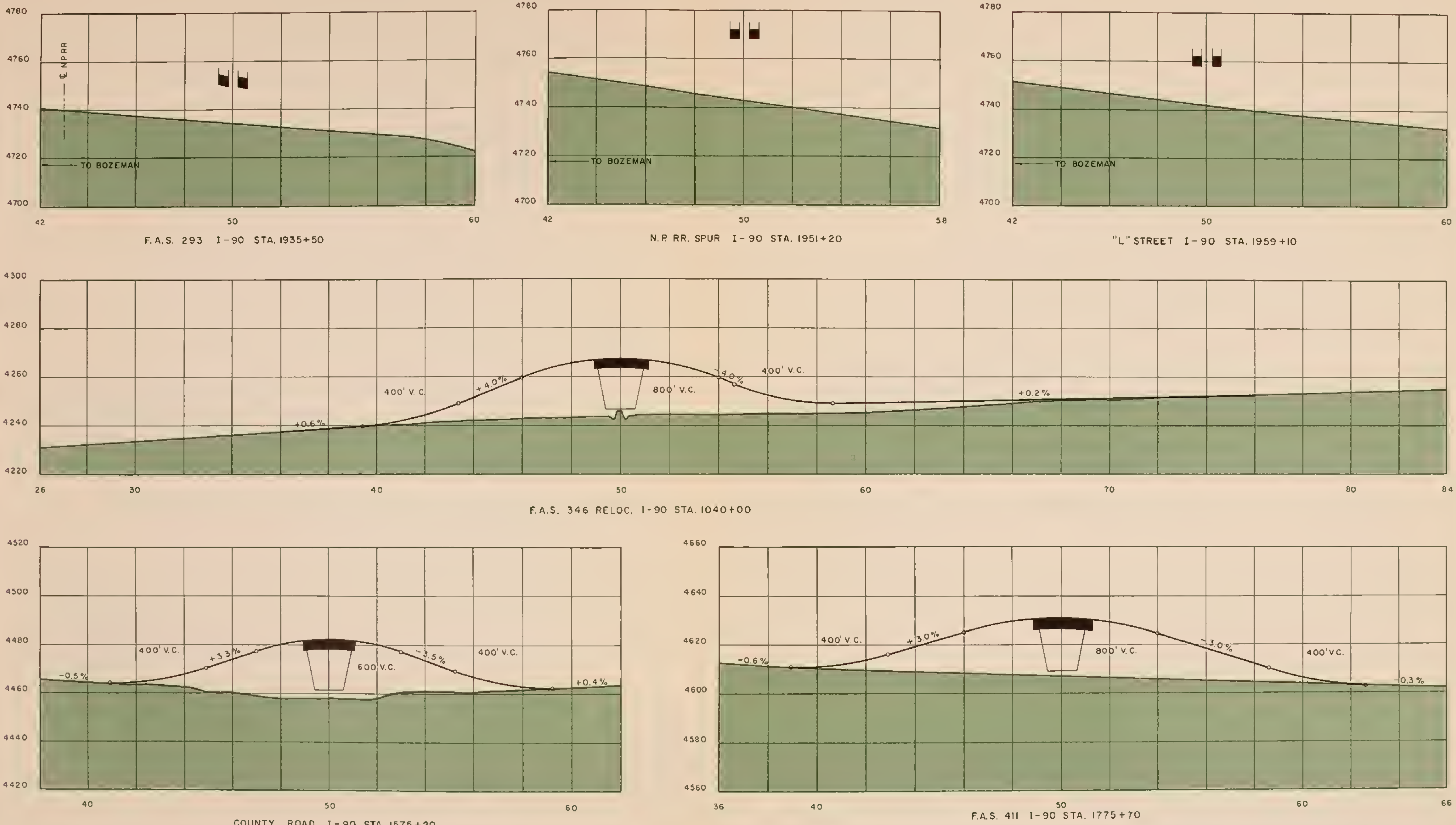
HORIZONTAL 0 100 200 400 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

CROSSROAD AND RAILROAD PROFILES ROUTE 1



SCALE

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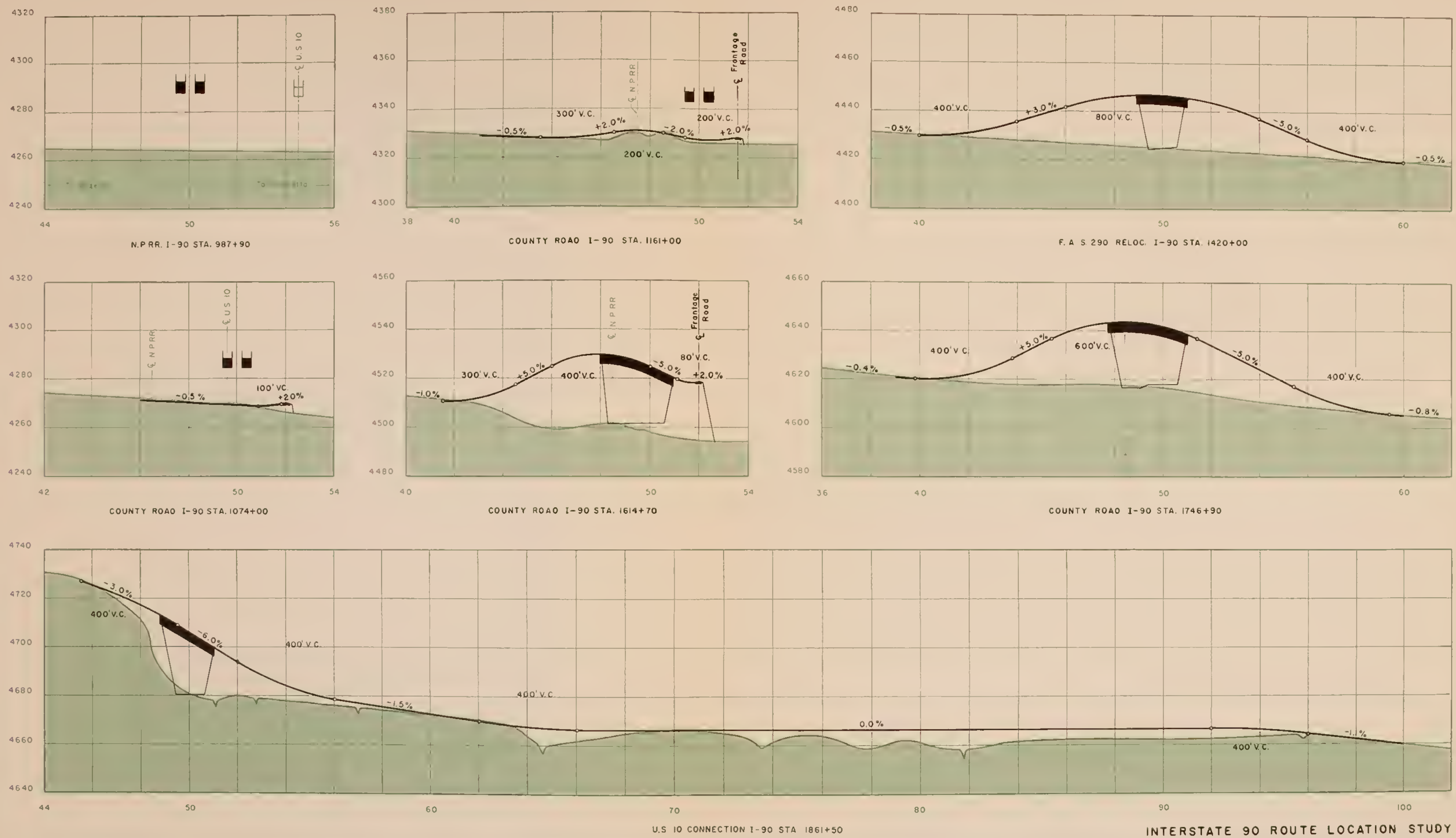
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

CROSSROAD AND RAILROAD PROFILES
ROUTE I



SCALE

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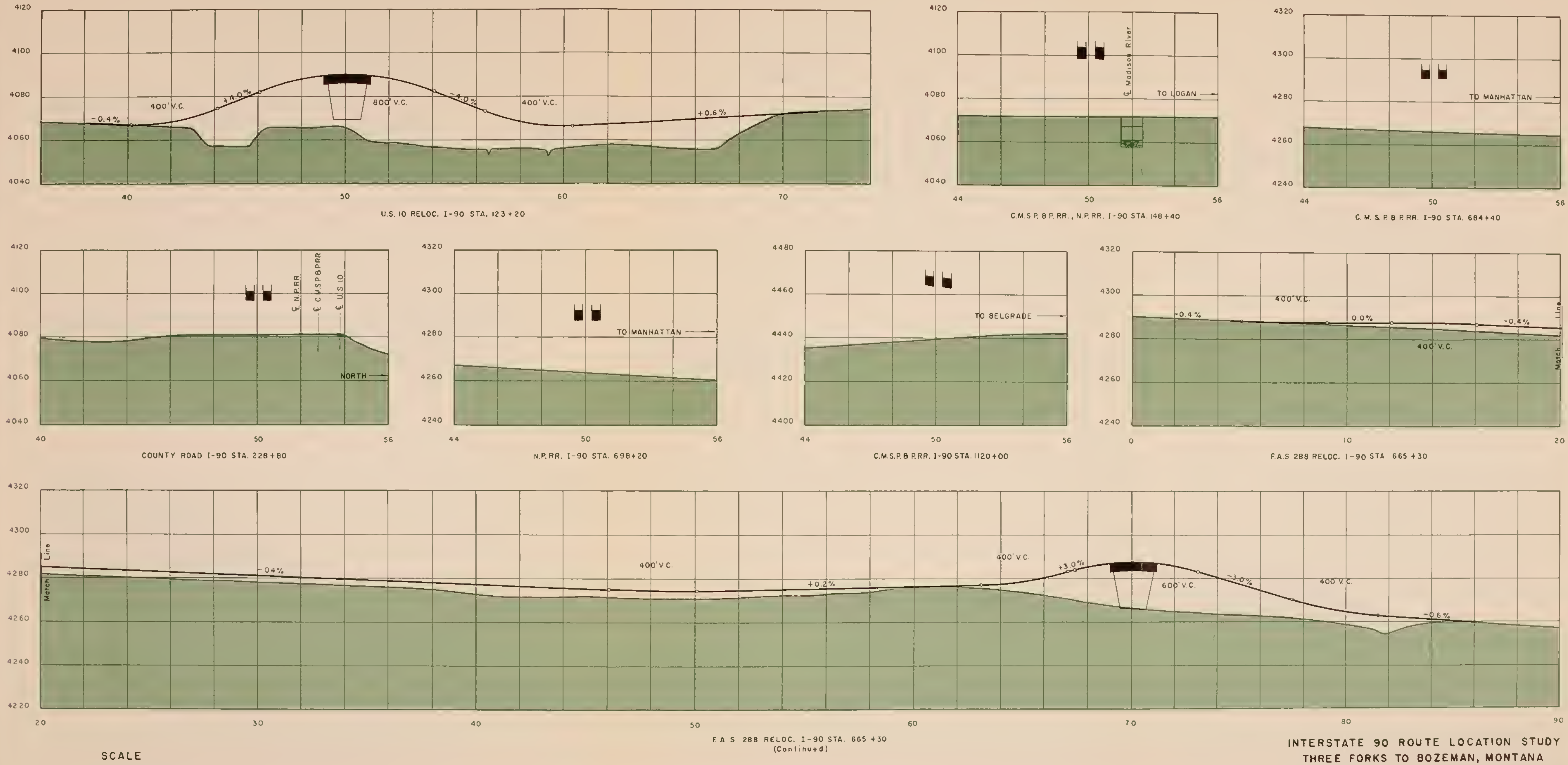
VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

CROSSROAD AND RAILROAD PROFILES ROUTE 2

EXHIBIT 34



SCALE

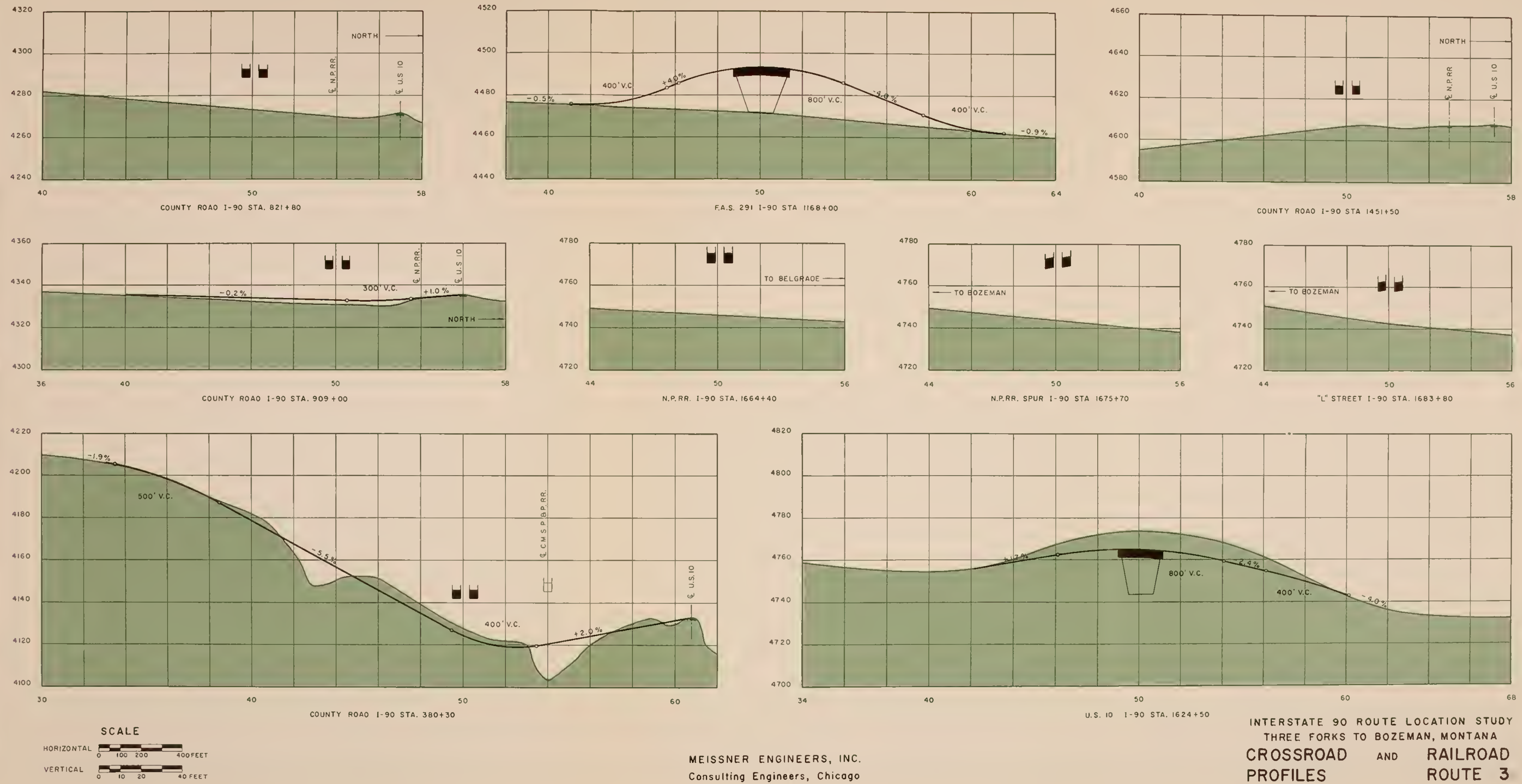
HORIZONTAL 0 100 200 400 FEET

VERTICAL 0 10 20 40 FEET

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

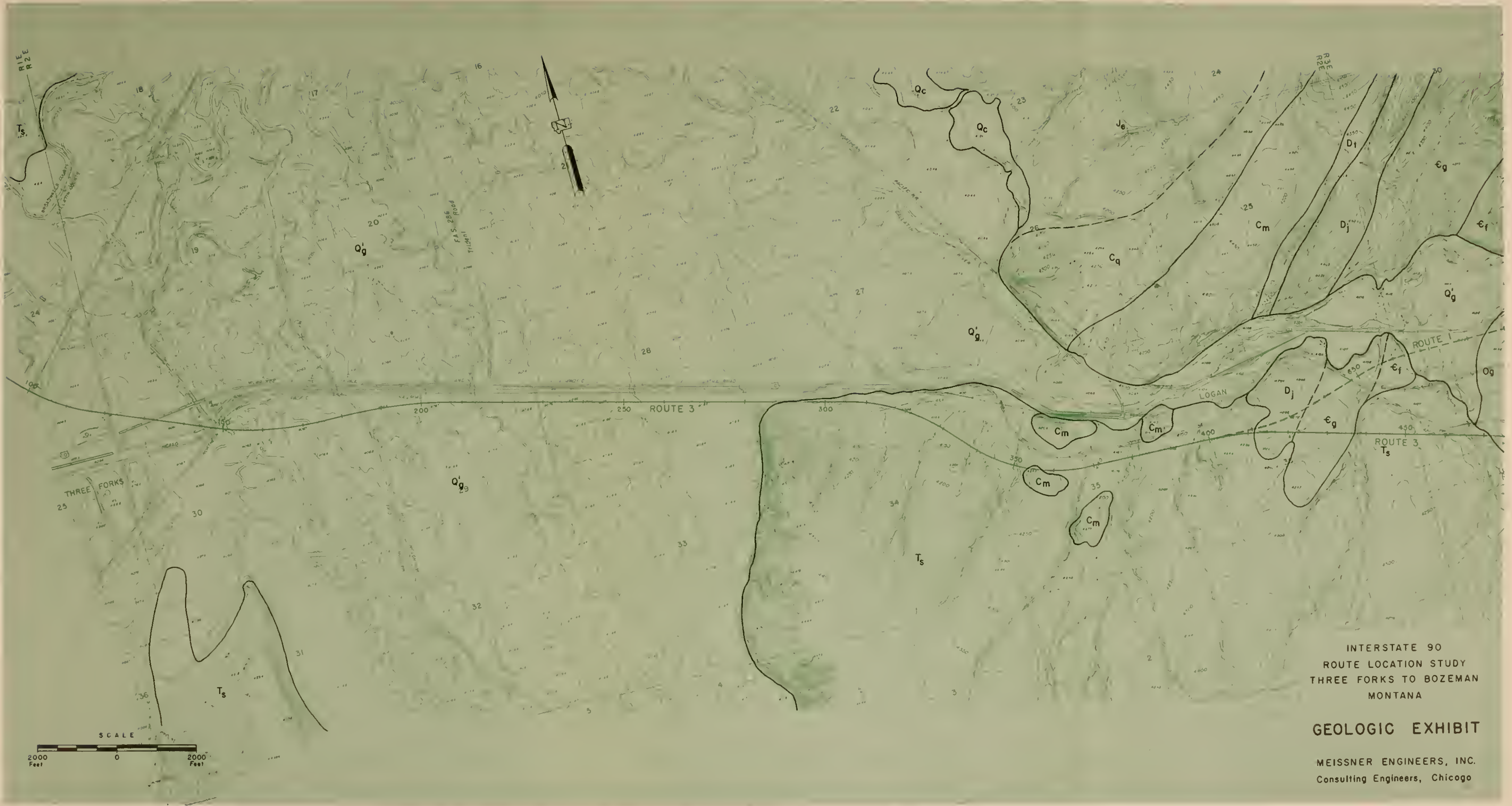
CROSSROAD AND RAILROAD PROFILES ROUTE 3



MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA

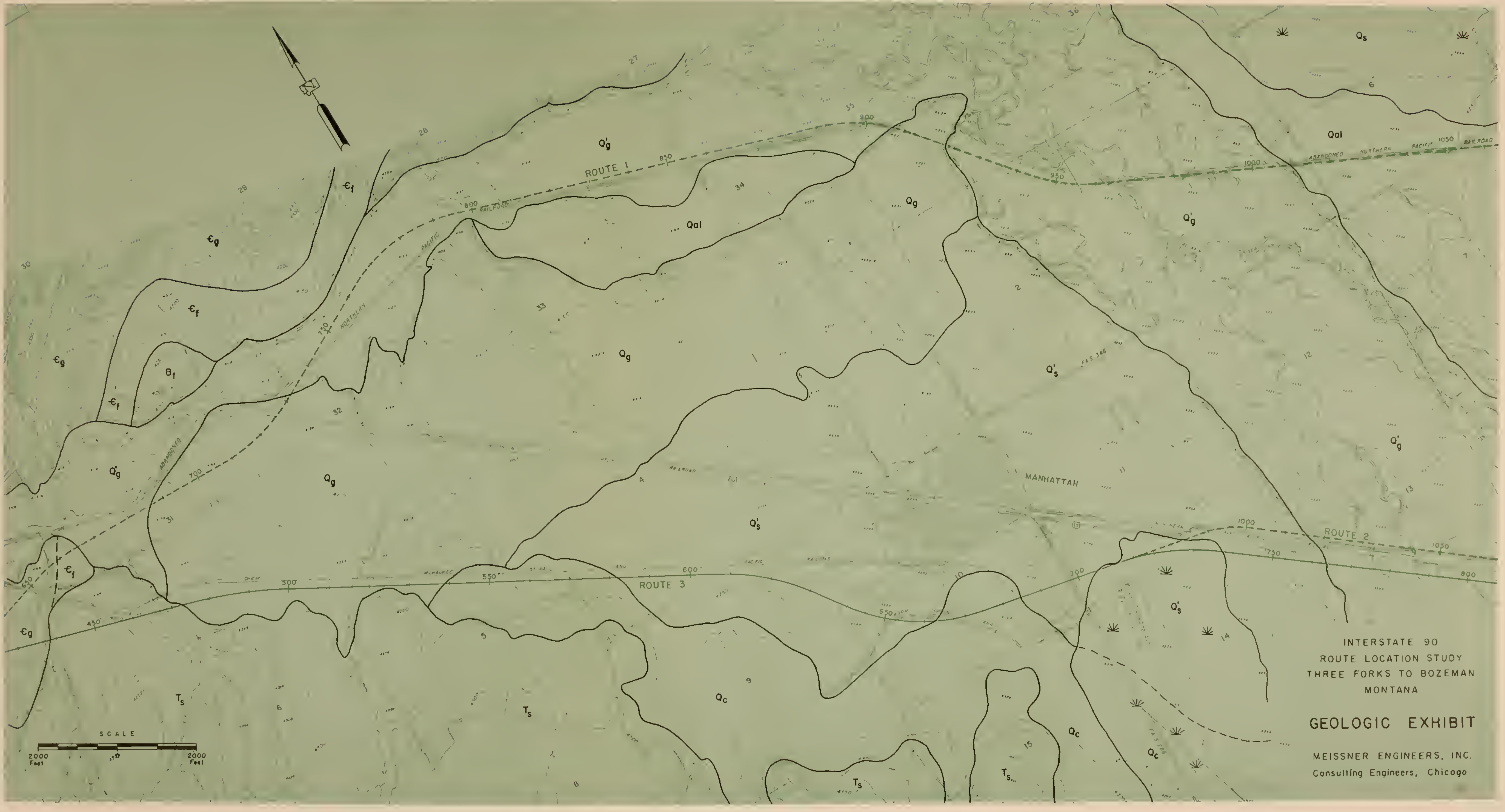
CROSSROAD AND RAILROAD PROFILES ROUTE 3



INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

GEOLOGIC EXHIBIT

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

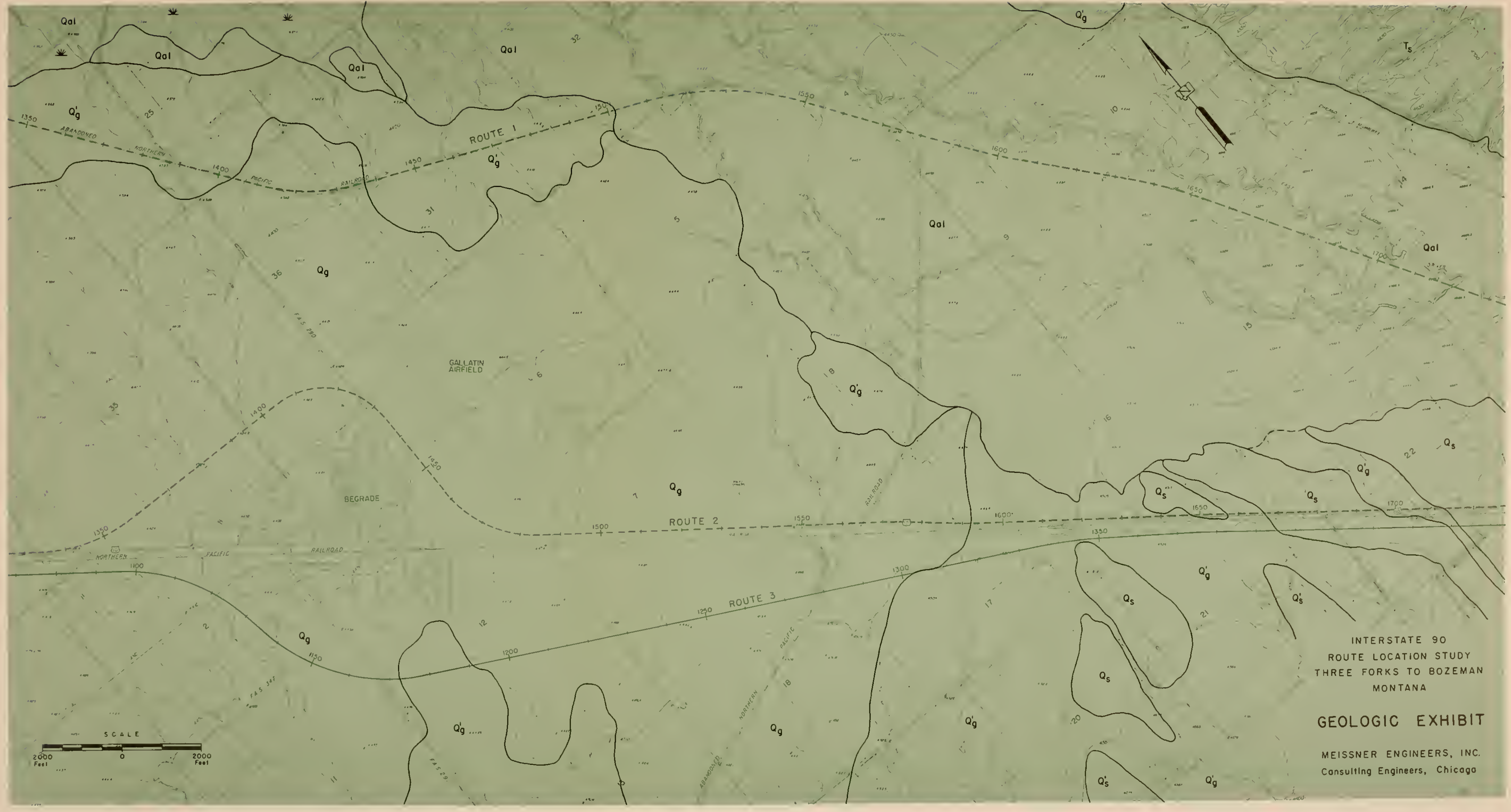


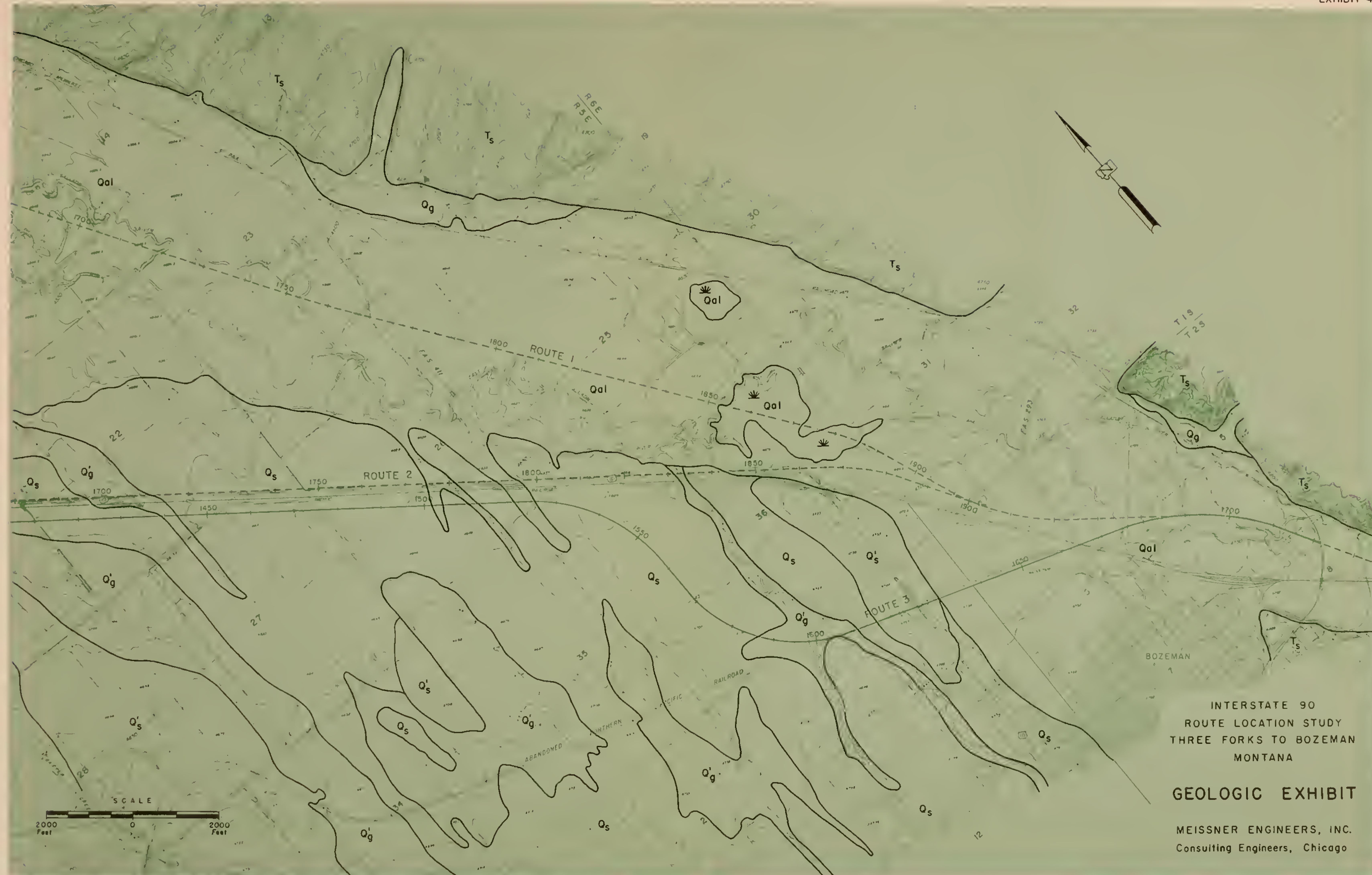
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA
GEOLOGIC EXHIBIT
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago
ROUTE 1
ROUTE 2
ROUTE 3
MANHATTAN
SCALE
ABANDONED NORTHERN PACIFIC RAILROAD
Qal
Q's
Q'g
Qg
Qs
Qc
Ts
€g
€f

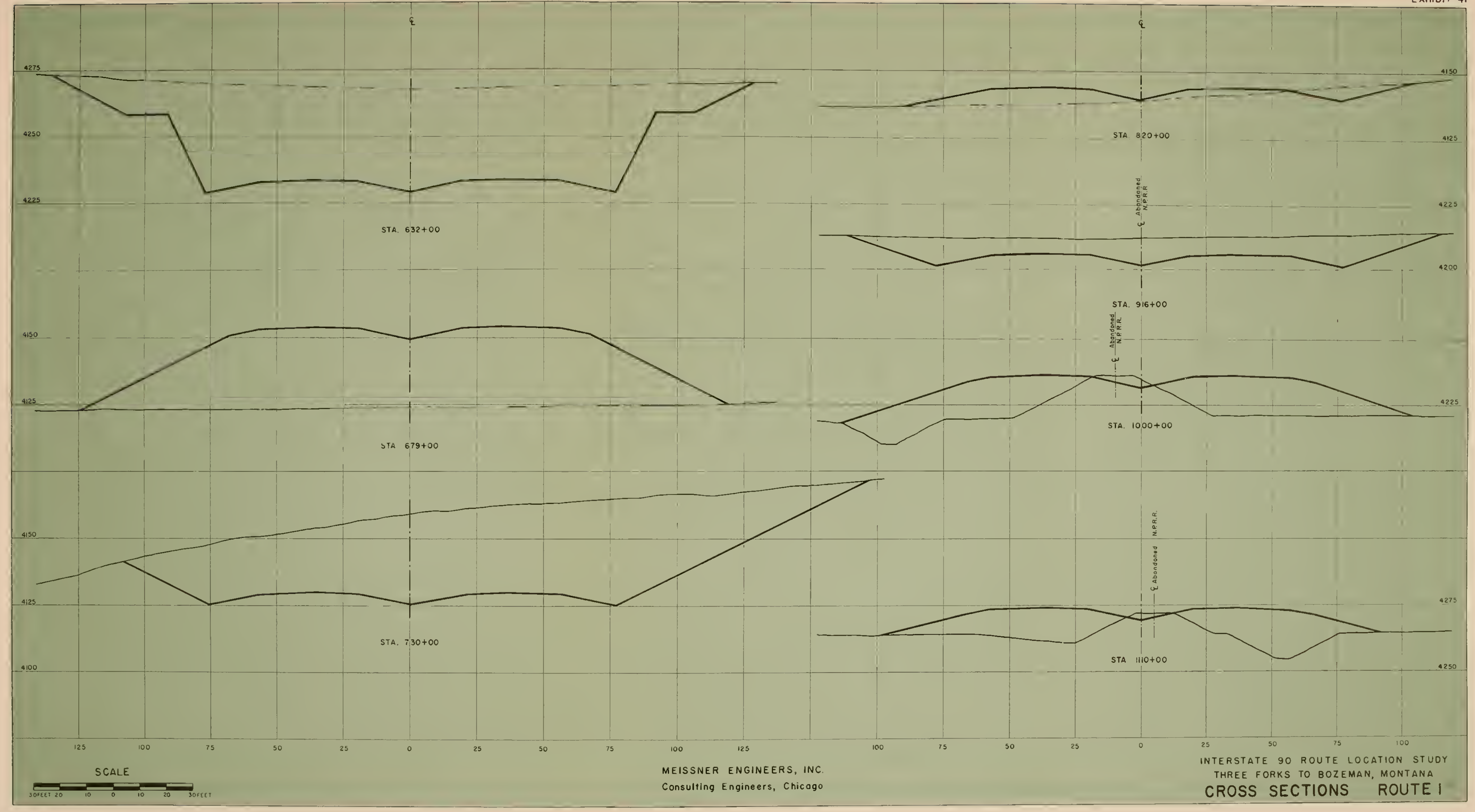
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA

GEOLOGIC EXHIBIT

MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago


Qal
Q'g
Qg
Qs
Q's
Ts
ROUTE 1
ROUTE 2
ROUTE 3
ABANDONED NORTHERN PACIFIC RAILROAD
NORTHERN PACIFIC RAILROAD
GALLATIN AIRFIELD
BEGRADE
SCALE
2000 Feet
0
2000 Feet
INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA
GEOLOGIC EXHIBIT
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

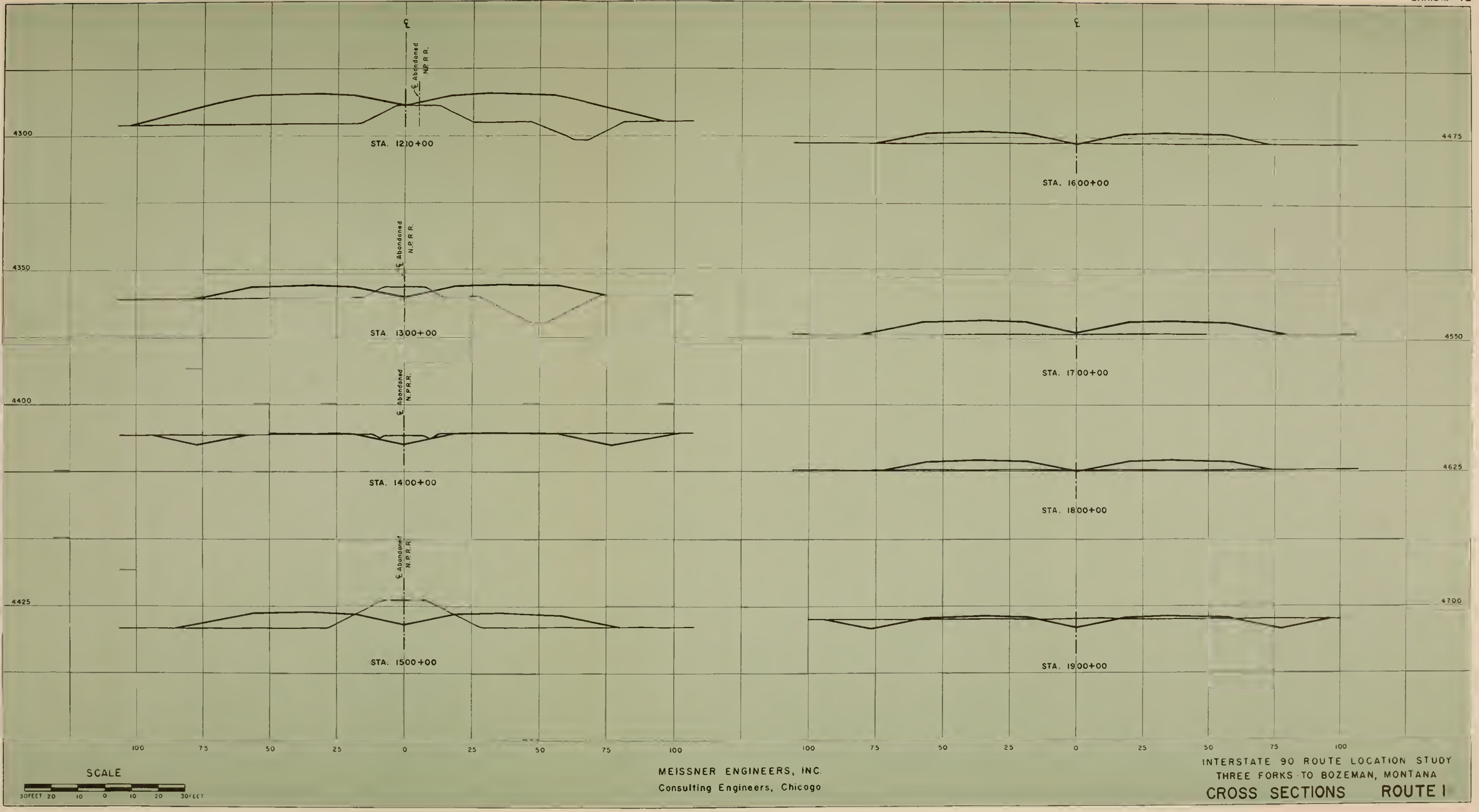

INTERSTATE 90
ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN
MONTANA
GEOLOGIC EXHIBIT
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago
SCALE
2000 Feet
0
2000 Feet
ROUTE 1
ROUTE 2
ROUTE 3
BOZEMAN
R6E
R5E
T1S
T2S
Ts
Qg
Qal
Qs
Q'g
Q's
ABANDONED NORTHERN PACIFIC RAILROAD



MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

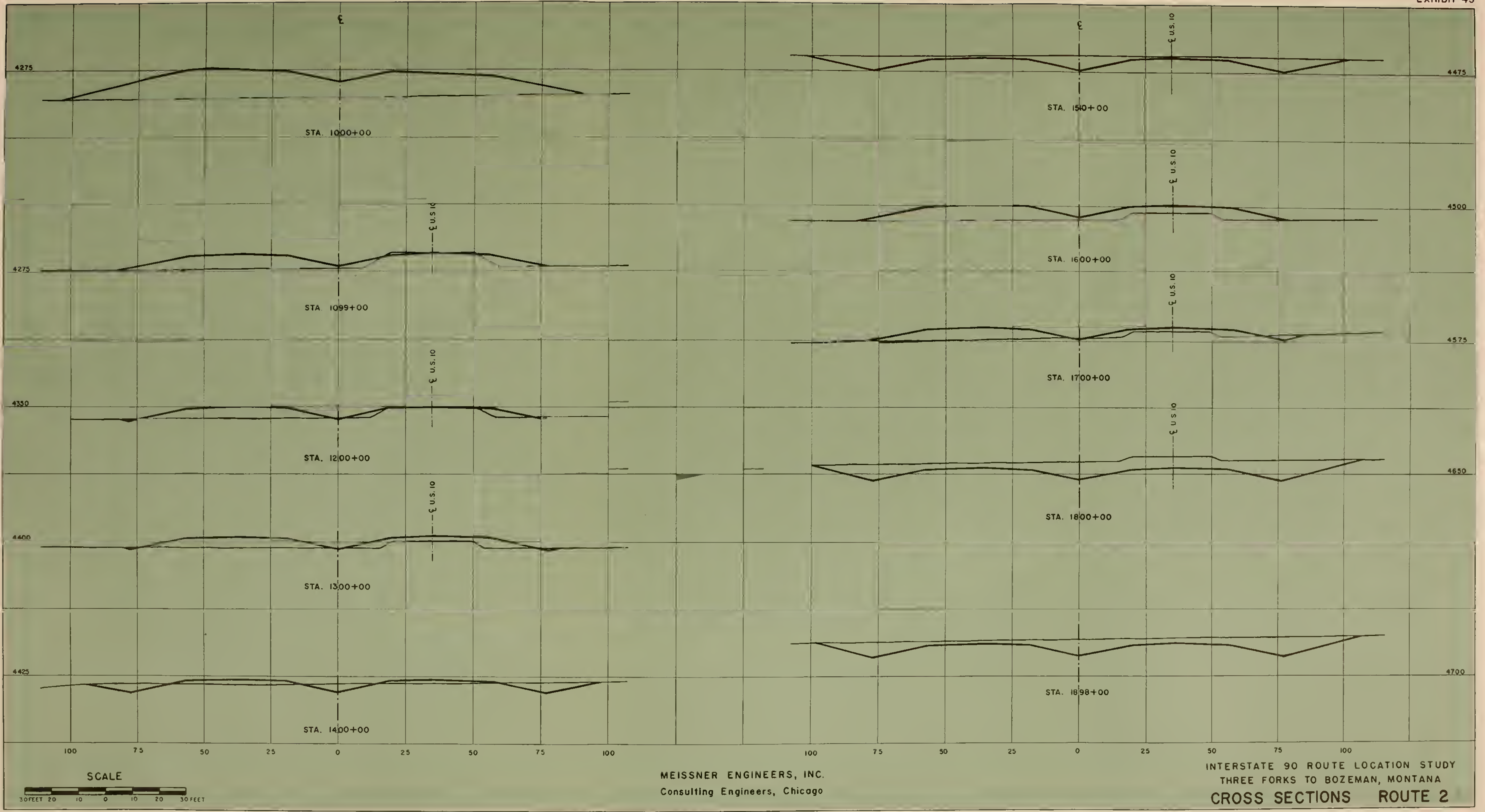
INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA
CROSS SECTIONS ROUTE I

EXHIBIT 42



℄
℄ Abandoned N.P.R.R.
4300
STA. 1210+00
4350
STA. 1300+00
4400
STA. 1400+00
4425
STA. 1500+00
4475
STA. 1600+00
4550
STA. 1700+00
4625
STA. 1800+00
4700
STA. 1900+00
100 75 50 25 0 25 50 75 100
SCALE
30FEET 20 10 0 10 20 30FEET
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago
INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA
CROSS SECTIONS ROUTE I

EXHIBIT 43



℄
℄
℄ U.S. 10
4275
STA. 1000+00
4275
STA. 1099+00
4350
STA. 1200+00
4400
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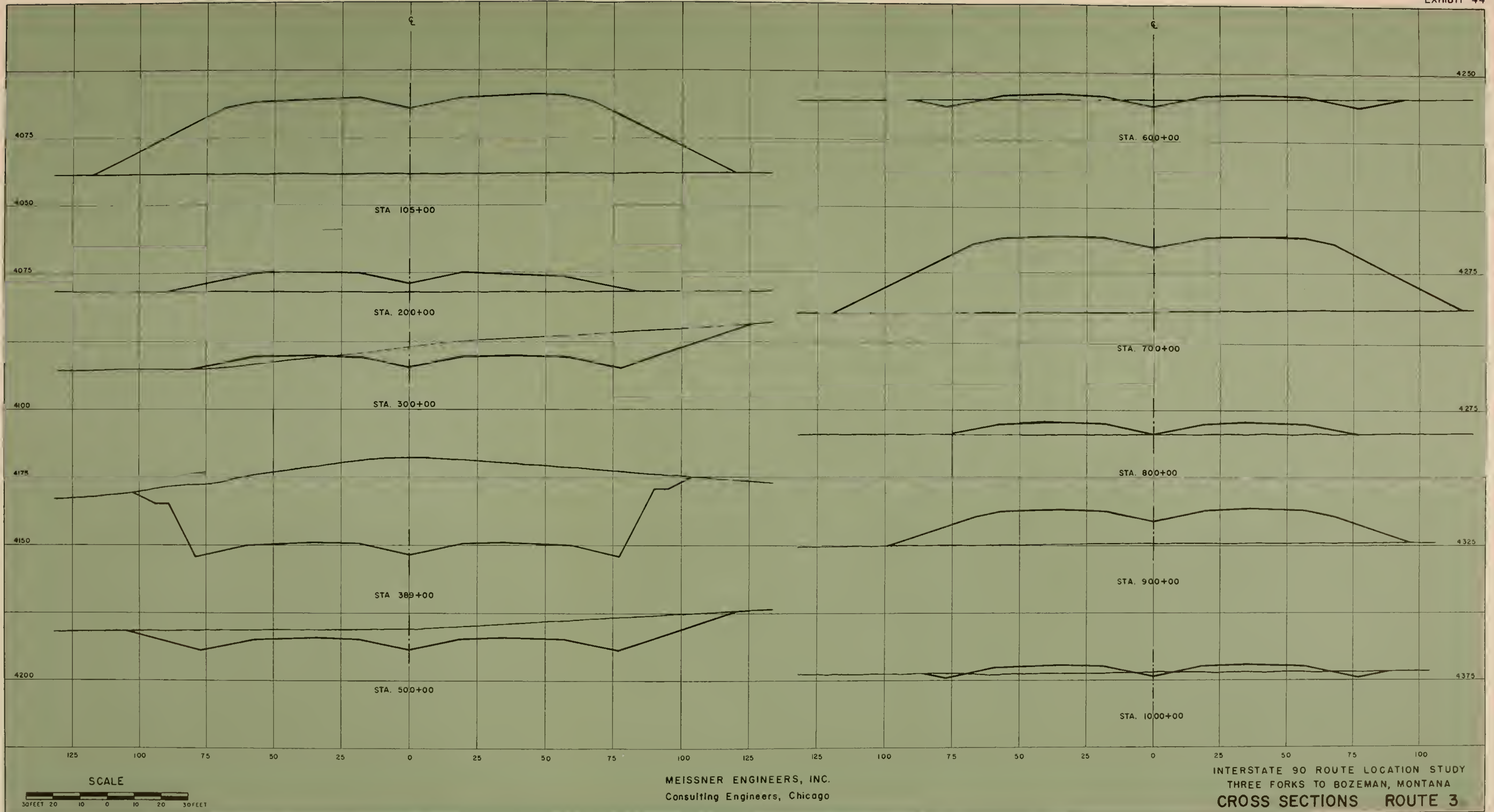
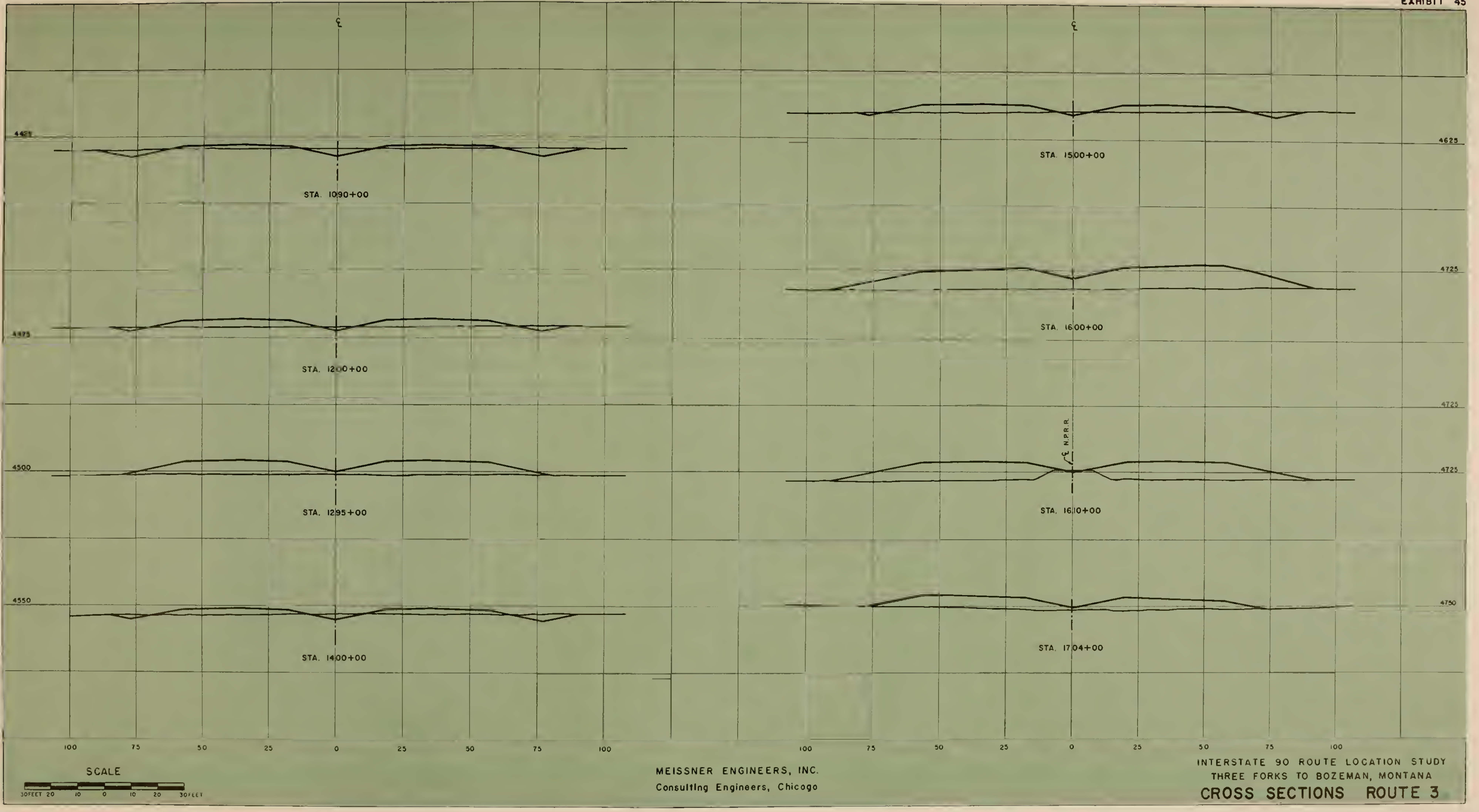
4425
STA. 1400+00
4475
STA. 1510+00
4500
STA. 1600+00
4575
STA. 1700+00
4650
STA. 1800+00
4700
STA. 1898+00
100 75 50 25 0 25 50 75 100
100 75 50 25 0 25 50 75 100
SCALE
30 FEET 20 10 0 10 20 30 FEET
MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago
INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA
CROSS SECTIONS ROUTE 2



MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA
CROSS SECTIONS ROUTE 3

EXHIBIT 45



MEISSNER ENGINEERS, INC.
Consulting Engineers, Chicago

INTERSTATE 90 ROUTE LOCATION STUDY
THREE FORKS TO BOZEMAN, MONTANA
CROSS SECTIONS ROUTE 3